Infrared foundations for quantum geometry. II. Catalog of all torsionlike theories including new ghost-tachyon-free cases

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The construction of consistent effective field theories in the infrared suggests that models be defined by their underlying gauge symmetries, rather than by a tuning of couplings of operators which may not be stable against radiative corrections. Adhering to this principle, we systematically derive all linear, parity-conserving models that propagate a pair-antisymmetric rank-three field on a Minkowski background. Such models are relevant not only to torsion, but to many areas in high-energy physics ranging from dual graviton formulations to string theory and higher-spin theories. Starting from the general 12-parameter quadratic action, we obtain 206 gauge-symmetric specializations, of which 22 are free of ghosts and tachyons. Following this exhaustive classification, none of the unitary models are found to propagate scalar or pseudoscalar torsion, in stark contrast to the literature focus on spin-zero torsion. Instead, all models propagate one or more vector torsion modes.

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I. INTRODUCTION

A. Consistent quantum theories

The principles of effective field theory (EFT), as detailed in [1,2] and illustrated in Fig. 1, dictate that a viable model for a field $\mathcal{K}$ should be constructed from the complete set of operators compatible with its underlying symmetries. This construction can be carried out via a perturbative approach, which is fundamentally a low-energy expansion organized in powers of the canonically normalized $\mathcal{K}$ and its derivatives

$$\mathcal{L} = \mathcal{L}_{n\leq 4} + \sum_{n=5}^{\infty} \sum_{i} \frac{{}^{(n)}\kappa_i \mathcal{O}^i{}_{(n)}}{\Lambda^{n-4}}. \tag{1}$$

In this expansion, the coefficients $\{{}^{(n)}\kappa_i\}$ are dimensionless couplings, where i indexes operators of the same mass dimension n, and Λ serves as the theory's cutoff scale.

Assuming the field $\mathcal{K}$ has a canonical mass dimension of one and that no higher derivatives are present, the bootstrap analysis starts with the Lagrangian $\mathcal{L}_{n\leq 4}$ in Eq. (1). This term includes all relevant and marginal operators encompassing possible cubic and quartic interactions, as well as the dominant part, responsible for propagation, quadratic in $\mathcal{K}$. For a high-rank tensor field, this general form of $\mathcal{L}_{n\leq 4}$ is typically nonunitary in the absence of additional coupling tunings: the spectrum of propagating degrees of freedom (d.o.f.) is not healthy. Accordingly, a self-consistent theory cannot be built upon the field $\mathcal{K}$ alone.

An especially principled way to obtain a self-consistent theory is to introduce the minimal coupling tunings required to induce one or more new gauge symmetries, so long as those same tunings happen to simultaneously restore unitarity. This "symmetrization" approach can be contrasted with the tuning of couplings that are *only* motivated by unitarity. In the former case, the tunings are expected to be protected against radiative corrections by the same symmetries that they define: they are basically consistent with the EFT principle. The radiative corrections themselves originate in the nonlinear (interacting) completion of the model; interactions which respect the underlying gauge symmetries can be attempted to be found systematically, through a consistent deformation procedure [3].

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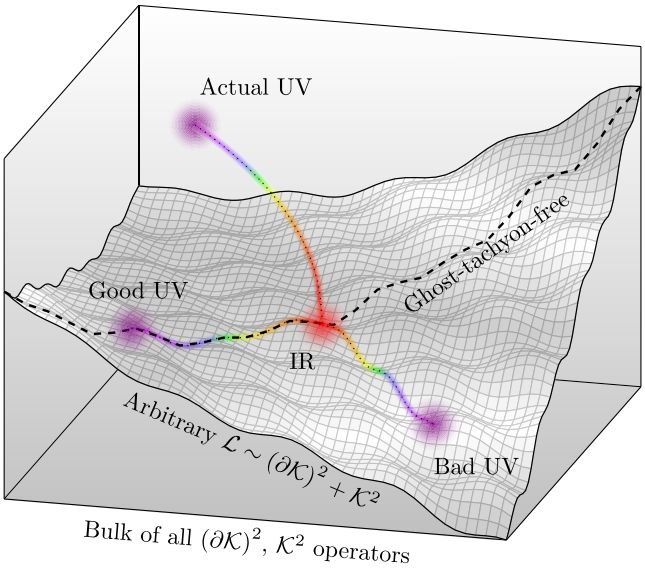


FIG. 1. The stability of a low-energy theory against radiative corrections is not guaranteed if its operator content is chosen arbitrarily. Any fine-tuning of couplings to ensure a ghost- and tachyon-free spectrum is generally undone by quantum loops. These issues are avoided when the model is defined by a gauge symmetry, which protects the physical properties of the theory in a robust and principled manner.

Tunings of the quadratic theory that are motivated by unitarity alone, or by some other property of the spectrum, are not generally stable in this way. In such cases, it may still be possible for stability to be carefully arranged on a case-by-case basis, through further tuning of the interacting sector.

In both approaches, the challenge of finding nonlinear completions is subtle and highly nontrivial: the systematic approach of [3] is not guaranteed to succeed, and may be used to demonstrate that no nonlinear completion exists at all. A model which does not have radiative stability is not systematically renormalizable, thus lacking any predictive power within the framework of Eq. (1) [4–15].

B. Pair-antisymmetric rank-three

In this paper, the particular choice for $\mathcal{K}$ is the pair-antisymmetric rank-three field of the form

$$\mathcal{K}_{\alpha\beta\gamma} \equiv -\mathcal{K}_{\alpha\gamma\beta}. \tag{2}$$

The high-energy physics literature provides many motivations for model-building from Eq. (2). Such a field may be endowed with a variety of interrelated physical interpretations (see the review [16]):

Dual graviton: As a Curtright field, i.e., a gauge potential whose linearized field strength is dual to the Fierz-Pauli graviton curvature [17]. In higher dimensions, this field carries the same on-shell d.o.f as a massless spin-two field, but in four dimensions its Weyl-like curvature vanishes identically [18,19]. A massive extension was proposed in [20].[1]

Monopoles and NUT charge: As the natural potential conjugate to Taub–NUT (magnetic) mass; in analogy to how a magnetic monopole sources a dual vector potential [21]. The field is sourced by the magnetic energy-momentum tensor, i.e., the stress-energy carried by the Dirac string or gravitational NUT charge, furnishing a local action principle and charge-quantization condition for gravitomagnetic charge [22,23].

Lanczos potential: As the Lanczos tensor, which serves as a potential for the Weyl tensor, providing a first-order, potential-based description of the free gravitational field in four dimensions [24].

String theory and higher spins: As one of an infinite tower of fields appearing in the tensionless limit of string theory (and in high-level excitations). The pair-antisymmetric case may arise along with fields of mixed symmetry [25,26]. In higher-spin theory the pair-antisymmetric field also plays a role as a gauge generator [27].

Unified theories: As the dual graviton of mixed symmetry which would arise alongside the four-dimensional metric in West's E_{11} Kac-Moody approach to M-theory. Such a field is required by extended symmetry algebras [28].

Following the earlier parts of this series in [1,2], this paper will focus, not on the above applications of Eq. (2), but on the application to spacetime torsion. Despite this focus, it is emphasized that the actual science product, the catalog of models derived below, has a much broader application.

C. Application to torsion

Compared to the totally symmetric rank-three field considered in [1,2], the pair-antisymmetric case has a more popular gravitational motivation in the context of extending general relativity (GR) [29]. Specifically, this index structure may be used to encode the spacetime *torsion* tensor $\mathcal{T}_\mu{}^\alpha{}_\nu \equiv -\mathcal{T}_\nu{}^\alpha{}_\mu$, whose geometric interpretation is illustrated in Fig. 2. The curvature of spacetime is defined as

$$\mathcal{F}_{\mu\nu}{}^\rho{}_\sigma \equiv 2(\partial_{[\mu}A_{\nu]}{}^\rho{}_\sigma + A_{[\mu|}{}^\rho{}_\alpha A_{|\nu]}{}^\alpha{}_\sigma), \tag{3}$$

where $A_\mu{}^\rho{}_\nu$ is the connection field, which is not a tensor owing to its inhomogeneous transformation under diffeomorphisms. In spacetimes where torsion is not assumed to vanish, it has the definition

$$\mathcal{T}_\mu{}^\alpha{}_\nu \equiv 2A_{[\mu|}{}^\alpha{}_{|\nu]}, \tag{4}$$

i.e., it is a tensor that can be extracted out of the non-tensorial connection. This can be equivalently understood

[1]Properly, the Curtright field should additionally specify Eq. (2) to have no totally antisymmetric part.

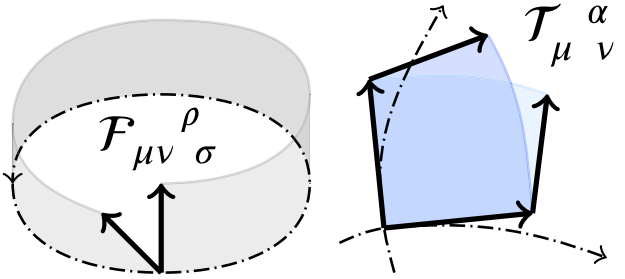


FIG. 2. The pair-antisymmetric rank-three field $\mathcal{K}^{\alpha}{}_{\beta\chi}$ in Eq. (2) has a natural interpretation through Eqs. (4), (5a) and (5b) as the spacetime torsion tensor $\mathcal{T}_{\mu}{}^{\alpha}{}_{\nu}$, which encodes an alternative geometric property of spacetime (nonclosure of infinitesimally parallel-transported vectors) to the curvature $\mathcal{F}_{\mu\nu}{}^{\rho}{}_{\sigma}$ in Eq. (3) (rotation of a vector upon parallel transport around a loop). As shown in [1], the universal infrared limit of propagating torsion is Eq. (6) in which "true" gravity (the metric perturbation) pays no role.

by partitioning $A_{\mu}{}^{\rho}{}_{\nu}$ into the connection-valued Levi–Civita part $\Gamma_{\mu}{}^{\nu}{}_{\rho} \equiv g^{\nu\lambda}(\partial_{(\mu}g_{\rho)\lambda} - \frac{1}{2}\partial_{\lambda}g_{\mu\rho})$, corresponding to the standard Christoffel symbols where $g_{\mu\nu}$ is the metric tensor, plus a tensor-valued linear function of the torsion known as the *contorsion* tensor

$$A_{\mu}{}^{\rho}{}_{\nu} \equiv \Gamma_{\mu}{}^{\rho}{}_{\nu} + \mathcal{K}_{\mu}{}^{\rho}{}_{\nu}, \tag{5a}$$

$$\mathcal{K}_{\alpha\beta\gamma} \equiv \frac{1}{2}(\mathcal{T}_{\alpha\beta\gamma} - \mathcal{T}_{\alpha\gamma\beta} + \mathcal{T}_{\beta\alpha\gamma}). \tag{5b}$$

It can be verified that Eqs. (4), (5a), and (5b) are mutually consistent. The inclusion of torsion leads to a generalized, post-Einsteinian spacetime geometry, as illustrated in Fig. 2.

Despite its appeal, Fig. 2 is not by itself a firm ground upon which to engage in model building [1]. The more compelling reason for considering torsion does not come from geometry, which served as the classical inspiration for GR. Rather, torsion emerges from the principle which connects both GR and the standard model of particle physics to the quantum framework of EFT: the principle of gauge theory. Specifically, torsion emerges as a covariant field-strength tensor in Poincaré gauge theory (PGT), as pioneered by Utiyama, Kibble and Sciama [30–32].

D. General Lagrangian

As shown in [1], if torsion is propagating at all, and if it is perturbative, then its universal infrared (IR) limit is captured by the quadratic theory of a pair-antisymmetric rank-three field in flat space $g_{\mu\nu} \to \eta_{\mu\nu}$. In this limit, there is no reference to actual gravity, which would otherwise appear as the dynamical perturbation of the metric $g_{\mu_{\nu}}$ around the background $\eta_{\mu\nu}$. Up to parity-violating operators, and physics on the boundary, this universal IR theory (denoted by $\aleph$ so as to distinguish it from various special cases) has Lagrangian

$$\begin{aligned}\mathcal{L}_{\aleph} \equiv {} & \overset{(2)}{\kappa}{}_1\Lambda^2\mathcal{K}_{\alpha\beta\chi}\mathcal{K}^{\alpha\beta\chi} + \overset{(2)}{\kappa}{}_2\Lambda^2\mathcal{K}_{\alpha\beta\chi}\mathcal{K}^{\beta\alpha\chi} \\ & + \overset{(2)}{\kappa}{}_3\Lambda^2\mathcal{K}^{\alpha}{}_{\alpha}{}^{\beta}\mathcal{K}^{\chi}{}_{\beta\chi} + \overset{(4)}{\kappa}{}_1\partial_{\beta}\mathcal{K}^{\delta}{}_{\chi\delta}\partial^{\chi}\mathcal{K}^{\alpha}{}_{\alpha}{}^{\beta} \\ & + \overset{(4)}{\kappa}{}_2\partial_{\chi}\mathcal{K}^{\delta}{}_{\beta\delta}\partial^{\chi}\mathcal{K}^{\alpha}{}_{\alpha}{}^{\beta} + \overset{(4)}{\kappa}{}_3\partial_{\beta}\mathcal{K}^{\alpha\beta\chi}\partial_{\delta}\mathcal{K}_{\alpha\chi}{}^{\delta} \\ & + \overset{(4)}{\kappa}{}_4\partial_{\alpha}\mathcal{K}^{\alpha\beta\chi}\partial_{\delta}\mathcal{K}_{\beta\chi}{}^{\delta} + \overset{(4)}{\kappa}{}_6\partial_{\beta}\mathcal{K}^{\alpha\beta\chi}\partial_{\delta}\mathcal{K}_{\chi\alpha}{}^{\delta} \\ & + \overset{(4)}{\kappa}{}_7\partial_{\chi}\mathcal{K}^{\alpha}{}_{\alpha}{}^{\beta}\partial_{\delta}\mathcal{K}_{\chi\beta}{}^{\delta} + \overset{(4)}{\kappa}{}_9\partial_{\alpha}\mathcal{K}^{\alpha\beta\chi}\partial_{\delta}\mathcal{K}^{\delta}{}_{\beta\chi} \\ & + \overset{(4)}{\kappa}{}_{15}\partial_{\delta}\mathcal{K}_{\alpha\beta\chi}\partial^{\delta}\mathcal{K}^{\alpha\beta\chi} + \overset{(4)}{\kappa}{}_{16}\partial_{\delta}\mathcal{K}_{\beta\alpha\chi}\partial^{\delta}\mathcal{K}^{\alpha\beta\chi}, \end{aligned} \tag{6}$$

where the canonical dimension of $\mathcal{K}_{\alpha\beta\chi}$ is unity. Note that the coupling indices are not consecutive: working from an algebraically general ansatz we have eliminated $\overset{(4)}{\kappa}{}_5$, $\overset{(4)}{\kappa}{}_8$, $\overset{(4)}{\kappa}{}_{10}$, $\overset{(4)}{\kappa}{}_{11}$, $\overset{(4)}{\kappa}{}_{12}$, $\overset{(4)}{\kappa}{}_{13}$, and $\overset{(4)}{\kappa}{}_{14}$ through integration by parts. Within the general 12-parameter action of Eq. (6), we will obtain 206 gauge-symmetric specializations, of which 22 are free of ghosts and tachyons.

E. Previous attempts

Part of Sec. III is allocated to performing a literature review of torsionful models that might connect to Eq. (6) as nonlinear completions, but before proceeding we particularly emphasize the linear analysis of Lin, Hobson and Lasenby in [33,34], which is very closely aligned with the present series. In that work the authors use spectral methods similar to those introduced in Sec. II to study a flat, quadratic model similar to that presented in Eq. (6). The important differences with the present letter are twofold.

First, the model in [33,34] includes not only the contorsion but also the metric perturbation,[2] and also couplings between the two. Whereas we have discarded such couplings in [1] as being irrelevant in the IR, the use of both fields in [33,34] stems from the assumption of a specialized nonlinear completion of the quadratic model. This nonlinear completion, to be introduced in Eq. (15), actually *restricts* the basis of kinetic operators to be smaller than that in Eq. (6).

The specific choice of nonlinear completion also accounts for the second difference between [33,34] and the present letter: the catalog in [33,34] was obtained by tuning couplings to achieve simultaneous unitarity of the spectrum *and* power-counting renormalizability, where the nonlinear completion is needed to make claims about the latter. Generally, the linear models obtained in this way will feature symmetries which are not respected by the nonlinear operators that were used to motivate them in the first place. The consequences of this are discussed above: the current approach is not affected by the pathologies of a top-down specification of the interactions, although it can still fail if consistent bottom-up interactions do not exist.

[2]More correctly, the fields used in [33,34] are the spin connection and the tetrad perturbation, but the extra constraint of Poincaré gauge invariance makes this distinction physically irrelevant.

Specifically, not only do we require the models to be healthy already in their nongravitating limit (a consequence of the universal coupling to gravity), but the starting operator basis in Eq. (6) is *general*, and *agnostic* about the nonlinear completion. The nonlinear completion, if any can be found at all, is expected to be dictated order-by-order through a consistent deformation process [3].

F. In this paper

The remainder of this paper has the following structure. In Sec. II we recap the theory behind the algorithm used for systematically deriving physically motivated special cases of Eq. (6). The exposition is brief, because this content was presented in full already in [2]. In Sec. III, the results of the survey are presented and their physical implications are discussed. The complete catalog resulting from this work can be found in Appendix. We take $\hbar \equiv c \equiv 1$, and the high-energy physics convention $(+,-,-,-)$. Otherwise, we use the conventions of [35].

II. THEORETICAL DEVELOPMENT

A. Wave operator

To evaluate the tree-level spectrum for each of the symmetric specializations of Eq. (6), the *PSALTer* software package is used [36,37]. The core of this method is the study of the propagator associated with a given Lagrangian $\mathcal{L}_{n\leq 4}$. This is understood to depend on the field d.o.f. in $\mathcal{K}_{\alpha\beta\chi}$, including derivatives, along with the parameters $\{\overset{(n)}{\kappa}_i\}$, and Λ.

While it might seem unusual to parametrize the mass terms in the quadratic action as multiples of the cutoff scale Λ, this nomenclature is justified in an EFT context, where the smallness of the $\{\overset{(2)}{\kappa}_i\}$ plays an important perturbative role, as in the case of small quark masses in chiral perturbation theory [38].

Test sources $\mathcal{J}^{\alpha\beta\chi}$ are introduced through the definition $\mathcal{S} \equiv \int \mathrm{d}^4x[\mathcal{L}_{n\leq 4} - \mathcal{K}_{\alpha\beta\chi}\mathcal{J}^{\alpha\beta\chi}]$. For the computational implementation, the independent d.o.f of $\mathcal{K}_{\alpha\beta\chi}$ and the source $\mathcal{J}^{\alpha\beta\chi}$ are represented by column vectors, denoted K and J respectively. In position space, this action can be written schematically as

$$\mathcal{S} = \int \mathrm{d}^4x\, \mathsf{K}^{\mathrm{T}}(x) \cdot [\mathsf{O}(\partial) \cdot \mathsf{K}(x) - \mathsf{J}(x)]. \tag{7}$$

The wave operator $\mathsf{O}(\partial)$ is a polynomial tensor, at most quadratic in the derivative operator ∂, whose coefficients depend on the couplings $\{\overset{(n)}{\kappa}_i\}$ and are parametrized by the cutoff scale.

B. Saturated propagator

The saturated propagator corresponding to the action in Eq. (7) is determined in momentum space, where the Fourier transform is effected by the replacement $\partial_\mu \mapsto -ik_\mu$.

The calculation proceeds by inverting the wave operator and contracting it with the sources, as given in

$$\Pi(k) \equiv \mathsf{J}^\dagger(k) \cdot \mathsf{O}^{-1}(k) \cdot \mathsf{J}(k). \tag{8}$$

The special cases of Eq. (6) under consideration are, by construction, endowed with additional gauge symmetries. A direct consequence of these symmetries is the degeneracy of the wave operator, which makes its formal inverse in Eq. (8) singular. This issue is resolved because the same symmetries impose constraints on the source currents, ensuring that the divergences from the inverse are nullified in the "sandwiching" procedure of Eq. (8). Standard pology principles are then applied to extract the physical content: poles in $\Pi(k)$ correspond to particle masses—which must be real to exclude tachyons—and the associated residues must be positive definite to preclude ghosts.

C. Massive spin and parity

For massive states, the analysis is greatly facilitated by employing a basis of definite spin and parity (J^P), which simplifies the wave operator inversion into a set of more manageable linear algebra problems. In this basis, the wave operator block decomposes into a direct sum over these irreducible subspaces

$$\mathsf{O}(k) \equiv \bigoplus_{J,P} \mathsf{O}_{J^P}(k). \tag{9}$$

The spectroscopic analysis proceeds independently in each J^P subspace, which *PSALTer* automatically identifies for the field $\mathcal{K}_{\alpha\beta\chi}$, as detailed in Table I. With this decomposition, it is possible to compute the spectrograph for the unconstrained theory $\aleph$ in Eq. (6), shown in Fig. 3.

All poles in the general theory are found to be massive. The 1^+ and 1^- sectors each contain a pair of propagating states, whose squared masses are nonrational functions of the couplings $\{\overset{(n)}{\kappa}_i\}$, as they derive from a quadratic equation in $k \equiv \sqrt{k^\nu k_\nu}$. To avoid cumbersome symbolic manipulations, *PSALTer* designates these poles as "unresolved." The pathology of the theory is nevertheless evident from the "resolved" poles: the 0^+, 0^-, 2^+ and 2^- sectors exhibit conflicting no-ghost and no-tachyon conditions for their respective single poles. This finding reinforces the argument from Sec. I that some tuning of couplings—ideally from the imposition of gauge symmetries—is needed. Imposing such symmetries will characteristically render some states massless, as in the familiar Fierz-Pauli and Proca examples, thereby requiring a subsequent analysis of massless poles.

D. Massless helicity

The analysis of massless particles requires a shift from the spin-parity (J^P) basis, appropriate for massive states, to one of definite helicity (h). While the *PSALTer* software computes the number and unitarity of massless modes via a

TABLE I. Output generated by *PSALTer*. Kinematic decomposition of the pair-antisymmetric field from Eq. (2), providing the basis for the spectrographs in Figs. 3 and 6 to 8. The unit-timelike vector $n_\mu \equiv k_\mu/\sqrt{k^\nu k_\nu}$ is constructed using the four-momentum k_μ of a massive particle.

Fundamental field	Symmetries	Decomposition into SO(3) irrep(s)	Source
$\mathcal{K}_{\alpha\beta\chi}$	$\mathcal{K}_{\alpha\chi\beta} = -\mathcal{K}_{\alpha\beta\chi}$	$\mathcal{K}^{\#1}_{0^-\,\alpha\beta\chi} - \frac{1}{2}\,\eta_{\alpha\chi}\,\mathcal{K}^{\#1}_{1^-\,\beta} + \frac{1}{2}\,\eta_{\alpha\beta}\,\mathcal{K}^{\#1}_{1^-\,\chi} + \frac{4}{3}\,\mathcal{K}^{\#1}_{2^-\,\beta\chi\alpha} + \mathcal{K}^{\#2}_{1^+\,\beta\chi}\,n_\alpha +$ $\frac{1}{3}\,\eta_{\alpha\chi}\,\mathcal{K}^{\#1}_{0^+}\,n_\beta - \mathcal{K}^{\#1}_{1^+\,\alpha\chi}\,n_\beta + \mathcal{K}^{\#1}_{2^+\,\alpha\chi}\,n_\beta - \frac{1}{2}\,\mathcal{K}^{\#1}_{1^-\,\chi}\,n_\alpha\,n_\beta - \mathcal{K}^{\#2}_{1^-\,\chi}\,n_\alpha\,n_\beta -$ $\frac{1}{3}\,\eta_{\alpha\beta}\,\mathcal{K}^{\#1}_{0^+}\,n_\chi + \mathcal{K}^{\#1}_{1^+\,\alpha\beta}\,n_\chi - \mathcal{K}^{\#1}_{2^+\,\alpha\beta}\,n_\chi + \frac{1}{2}\,\mathcal{K}^{\#1}_{1^-\,\beta}\,n_\alpha\,n_\chi + \mathcal{K}^{\#2}_{1^-\,\beta}\,n_\alpha\,n_\chi$	$\mathcal{J}_{\alpha\beta\chi}$
SO(3) irrep	Symmetries	Expansion in terms of the fundamental field	Source SO(3) irrep
$\mathcal{K}^{\#1}_{0^+}$	(None)	$\mathcal{K}^{\beta}_{\ \alpha\beta}\,n^\alpha$	$\mathcal{J}^{\#1}_{0^+}$
$\mathcal{K}^{\#1}_{0^-\,\alpha\beta\chi}$	$\mathcal{K}^{\#1}_{0^-\,\alpha\chi\beta} = -\mathcal{K}^{\#1}_{0^-\,\alpha\beta\chi}$ && $\mathcal{K}^{\#1}_{0^-\,\beta\alpha\chi} = -\mathcal{K}^{\#1}_{0^-\,\alpha\beta\chi}$	$\frac{1}{3}\,\mathcal{K}_{\alpha\beta\chi} - \frac{1}{3}\,\mathcal{K}_{\beta\alpha\chi} + \frac{1}{3}\,\mathcal{K}_{\chi\alpha\beta} - \frac{1}{3}\,\mathcal{K}_{\beta\chi\delta}\,n_\alpha\,n^\delta +$ $\frac{1}{3}\,\mathcal{K}_{\chi\beta\delta}\,n_\alpha\,n^\delta - \frac{1}{3}\,\mathcal{K}_{\delta\beta\chi}\,n_\alpha\,n^\delta + \frac{1}{3}\,\mathcal{K}_{\alpha\chi\delta}\,n_\beta\,n^\delta - \frac{1}{3}\,\mathcal{K}_{\chi\alpha\delta}\,n_\beta\,n^\delta +$ $\frac{1}{3}\,\mathcal{K}_{\delta\alpha\chi}\,n_\beta\,n^\delta - \frac{1}{3}\,\mathcal{K}_{\alpha\beta\delta}\,n_\chi\,n^\delta + \frac{1}{3}\,\mathcal{K}_{\beta\alpha\delta}\,n_\chi\,n^\delta - \frac{1}{3}\,\mathcal{K}_{\delta\alpha\beta}\,n_\chi\,n^\delta$	$\mathcal{J}^{\#1}_{0^-\,\alpha\beta\chi}$
$\mathcal{K}^{\#1}_{1^+\,\alpha\beta}$	$\mathcal{K}^{\#1}_{1^+\,\beta\alpha} = -\mathcal{K}^{\#1}_{1^+\,\alpha\beta}$	$\frac{1}{2}\,\mathcal{K}_{\alpha\beta\chi}\,n^\chi - \frac{1}{2}\,\mathcal{K}_{\beta\alpha\chi}\,n^\chi - \frac{1}{2}\,\mathcal{K}_{\chi\beta\delta}\,n_\alpha\,n^\chi\,n^\delta + \frac{1}{2}\,\mathcal{K}_{\chi\alpha\delta}\,n_\beta\,n^\chi\,n^\delta$	$\mathcal{J}^{\#1}_{1^+\,\alpha\beta}$
$\mathcal{K}^{\#2}_{1^+\,\alpha\beta}$	$\mathcal{K}^{\#2}_{1^+\,\beta\alpha} = -\mathcal{K}^{\#2}_{1^+\,\alpha\beta}$	$\mathcal{K}_{\chi\alpha\beta}\,n^\chi + \mathcal{K}_{\chi\beta\delta}\,n_\alpha\,n^\chi\,n^\delta - \mathcal{K}_{\chi\alpha\delta}\,n_\beta\,n^\chi\,n^\delta$	$\mathcal{J}^{\#2}_{1^+\,\alpha\beta}$
$\mathcal{K}^{\#1}_{1^-\,\alpha}$	(None)	$-\mathcal{K}^{\beta}_{\ \alpha\beta} + \mathcal{K}^{\chi}_{\ \beta\chi}\,n_\alpha\,n^\beta + \mathcal{K}_{\beta\alpha\chi}\,n^\beta\,n^\chi$	$\mathcal{J}^{\#1}_{1^-\,\alpha}$
$\mathcal{K}^{\#2}_{1^-\,\alpha}$	(None)	$\mathcal{K}_{\beta\alpha\chi}\,n^\beta\,n^\chi$	$\mathcal{J}^{\#2}_{1^-\,\alpha}$
$\mathcal{K}^{\#1}_{2^+\,\alpha\beta}$	$\mathcal{K}^{\#1}_{2^+\,\beta\alpha} = \mathcal{K}^{\#1}_{2^+\,\alpha\beta}$	$-\frac{1}{2}\,\mathcal{K}_{\alpha\beta\chi}\,n^\chi - \frac{1}{2}\,\mathcal{K}_{\beta\alpha\chi}\,n^\chi - \frac{1}{3}\,\eta_{\alpha\beta}\,\mathcal{K}^{\delta}_{\ \chi\delta}\,n^\chi +$ $\frac{1}{3}\,\mathcal{K}^{\delta}_{\ \chi\delta}\,n_\alpha\,n_\beta\,n^\chi + \frac{1}{2}\,\mathcal{K}_{\chi\beta\delta}\,n_\alpha\,n^\chi\,n^\delta + \frac{1}{2}\,\mathcal{K}_{\chi\alpha\delta}\,n_\beta\,n^\chi\,n^\delta$	$\mathcal{J}^{\#1}_{2^+\,\alpha\beta}$
$\mathcal{K}^{\#1}_{2^-\,\alpha\beta\chi}$	$\mathcal{K}^{\#1}_{2^-\,\beta\alpha\chi} = -\mathcal{K}^{\#1}_{2^-\,\alpha\beta\chi}$	$-\frac{1}{4}\,\mathcal{K}_{\alpha\beta\chi} + \frac{1}{4}\,\mathcal{K}_{\beta\alpha\chi} + \frac{1}{2}\,\mathcal{K}_{\chi\alpha\beta} - \frac{3}{8}\,\eta_{\beta\chi}\,\mathcal{K}^{\delta}_{\ \alpha\delta} + \frac{3}{8}\,\eta_{\alpha\chi}\,\mathcal{K}^{\delta}_{\ \beta\delta} -$ $\frac{3}{8}\,\mathcal{K}^{\delta}_{\ \beta\delta}\,n_\alpha\,n_\chi + \frac{3}{8}\,\mathcal{K}^{\delta}_{\ \alpha\delta}\,n_\beta\,n_\chi + \frac{1}{4}\,\mathcal{K}_{\beta\chi\delta}\,n_\alpha\,n^\delta + \frac{1}{2}\,\mathcal{K}_{\chi\beta\delta}\,n_\alpha\,n^\delta +$ $\frac{1}{4}\,\mathcal{K}_{\delta\beta\chi}\,n_\alpha\,n^\delta + \frac{3}{8}\,\eta_{\beta\chi}\,\mathcal{K}^{\epsilon}_{\ \delta\epsilon}\,n_\alpha\,n^\delta - \frac{1}{4}\,\mathcal{K}_{\alpha\chi\delta}\,n_\beta\,n^\delta -$ $\frac{1}{2}\,\mathcal{K}_{\chi\alpha\delta}\,n_\beta\,n^\delta - \frac{1}{4}\,\mathcal{K}_{\delta\alpha\chi}\,n_\beta\,n^\delta - \frac{3}{8}\,\eta_{\alpha\chi}\,\mathcal{K}^{\epsilon}_{\ \delta\epsilon}\,n_\beta\,n^\delta +$ $\frac{1}{4}\,\mathcal{K}_{\alpha\beta\delta}\,n_\chi\,n^\delta - \frac{1}{4}\,\mathcal{K}_{\beta\alpha\delta}\,n_\chi\,n^\delta - \frac{1}{2}\,\mathcal{K}_{\delta\alpha\beta}\,n_\chi\,n^\delta + \frac{3}{8}\,\eta_{\beta\chi}\,\mathcal{K}_{\delta\alpha\epsilon}\,n^\delta\,n^\epsilon -$ $\frac{3}{8}\,\eta_{\alpha\chi}\,\mathcal{K}_{\delta\beta\epsilon}\,n^\delta\,n^\epsilon - \frac{3}{8}\,\mathcal{K}_{\delta\beta\epsilon}\,n_\alpha\,n_\chi\,n^\delta\,n^\epsilon + \frac{3}{8}\,\mathcal{K}_{\delta\alpha\epsilon}\,n_\beta\,n_\chi\,n^\delta\,n^\epsilon$	$\mathcal{J}^{\#1}_{2^-\,\alpha\beta\chi}$

component-wise analysis in the lightlike frame $[k^\mu] = (\omega, 0, 0, \omega)$, it does not intrinsically resolve their helicity content.

Following [2] the methodology of [36,37] is extended by constructing the helicity eigenstates from the source components. The procedure generalizes the well-known case of a vector source $\mathcal{J}^\mu$, for which the helicity-±1 states are the combinations $\varepsilon_{\pm1}(k) \equiv \mathcal{J}^1(k) \pm i\mathcal{J}^2(k)$. For the rank-three tensor source $\mathcal{J}^{\alpha\beta\gamma}(k)$, with the symmetry assumption following from Eq. (2) that $\mathcal{J}^{\alpha\beta\gamma}(k) \equiv -\mathcal{J}^{\alpha\gamma\beta}(k)$, the corresponding decomposition follows from standard angular momentum rules, and this procedure results in the formulas

$$\varepsilon^{\#1}_{\pm2} \equiv \mathcal{J}^{223} - \mathcal{J}^{113} \pm i(\mathcal{J}^{123} + \mathcal{J}^{213}), \tag{10a}$$

$$\varepsilon^{\#2}_{\pm2} \equiv \mathcal{J}^{202} - \mathcal{J}^{101} \pm i(\mathcal{J}^{102} + \mathcal{J}^{201}), \tag{10b}$$

$$\varepsilon^{\#1}_{\pm1} \equiv \mathcal{J}^{323} \pm i\mathcal{J}^{313}, \tag{10c}$$

$$\varepsilon^{\#2}_{\pm1} \equiv \mathcal{J}^{023} \pm i\mathcal{J}^{013}, \tag{10d}$$

$$\varepsilon^{\#3}_{\pm1} \equiv \mathcal{J}^{212} \pm i\mathcal{J}^{112}, \tag{10e}$$

$$\varepsilon^{\#4}_{\pm1} \equiv \mathcal{J}^{302} \pm i\mathcal{J}^{301}, \tag{10f}$$

$$\varepsilon^{\#5}_{\pm1} \equiv \mathcal{J}^{203} \pm i\mathcal{J}^{103}, \tag{10g}$$

$$\varepsilon^{\#6}_{\pm1} \equiv \mathcal{J}^{002} \pm i\mathcal{J}^{001}, \tag{10h}$$

$$\varepsilon^{\#1}_{0} \equiv \mathcal{J}^{113} + \mathcal{J}^{223}, \tag{10i}$$

$$\varepsilon^{\#2}_{0} \equiv \mathcal{J}^{123} - \mathcal{J}^{213}, \tag{10j}$$

$$\varepsilon^{\#3}_{0} \equiv \mathcal{J}^{312}, \tag{10k}$$

$$\varepsilon^{\#4}_{0} \equiv \mathcal{J}^{012}, \tag{10l}$$

$$\varepsilon^{\#5}_{0} \equiv \mathcal{J}^{303}, \tag{10m}$$

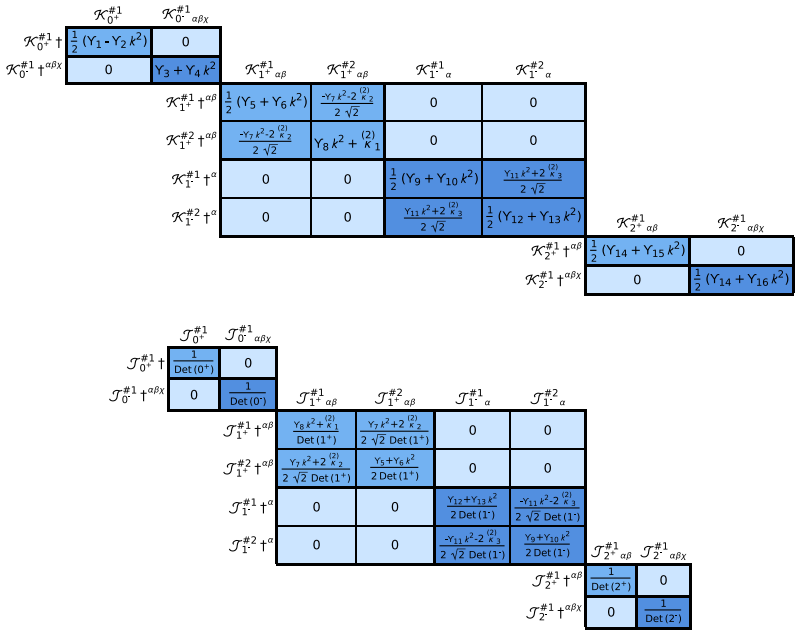
$$\varepsilon^{\#6}_{0} \equiv \mathcal{J}^{101} + \mathcal{J}^{202}, \tag{10n}$$

$$\varepsilon^{\#7}_{0} \equiv \mathcal{J}^{201} - \mathcal{J}^{102}, \tag{10o}$$

$$\varepsilon^{\#8}_{0} \equiv \mathcal{J}^{003}. \tag{10p}$$

Thus, for the 24 independent components of the pair-antisymmetric source $\mathcal{J}^{\alpha\beta\chi}(k)$, the combinations with definite helicity h are denoted by $\varepsilon^{\#d}_h$, where the superscript d distinguishes between degenerate states.

To apply these formulas to a specific model, one must account for the reduction in d.o.f. imposed by gauge symmetries. The component-wise procedure in *PSALTer* already manages these gauge constraints, which facilitates the construction of source combinations that are



Abbreviations used in matrices

$$\mathsf{Y}_1 == 2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - 3\,\overset{(2)}{\kappa}_3 \;\&\&\; \mathsf{Y}_2 == 3\,\overset{(4)}{\kappa}_1 - 2\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} + 3\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6 \;\&\&$$
$$\mathsf{Y}_3 == \overset{(2)}{\kappa}_1 - \overset{(2)}{\kappa}_2 \;\&\&\; \mathsf{Y}_4 == \overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} \;\&\&\; \mathsf{Y}_5 == 2\,\overset{(2)}{\kappa}_1 - \overset{(2)}{\kappa}_2 \;\&\&\; \mathsf{Y}_6 == 2\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6 \;\&\&$$
$$\mathsf{Y}_7 == 2\,\overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_4 \;\&\&\; \mathsf{Y}_8 == \overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_9 \;\&\&\; \mathsf{Y}_9 == 2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - 2\,\overset{(2)}{\kappa}_3 \;\&\&\; \mathsf{Y}_{10} == 2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16} - 2\,\overset{(4)}{\kappa}_2 \;\&\&$$
$$\mathsf{Y}_{11} == 2\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_7 \;\&\&\; \mathsf{Y}_{12} == 2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - \overset{(2)}{\kappa}_3 \;\&\&\; \mathsf{Y}_{13} == 2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_2 - \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_4 - \overset{(4)}{\kappa}_7 + 2\,\overset{(4)}{\kappa}_9 \;\&\&$$
$$\mathsf{Y}_{14} == 2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 \;\&\&\; \mathsf{Y}_{15} == 2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6 \;\&\&\; \mathsf{Y}_{16} == 2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16} \;\&\&$$
$$\mathrm{Det}\,(0^+) == \tfrac{1}{2}\,(-k^2\,(3\,\overset{(4)}{\kappa}_1 - 2\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} + 3\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6) + 2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - 3\,\overset{(2)}{\kappa}_3) \;\&\&$$
$$\mathrm{Det}\,(1^+) == \tfrac{1}{8}\,(k^4\,(8\,\overset{(4)}{\kappa}_{15}{}^2 - (-2\,\overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_4)^2 - 4\,\overset{(4)}{\kappa}_{15}\,(\overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6 - 2\,\overset{(4)}{\kappa}_9) - 4\,(\overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6)\,\overset{(4)}{\kappa}_9) +$$
$$4\,(\overset{(2)}{\kappa}_1 - \overset{(2)}{\kappa}_2)\,(2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2) + 4\,k^2\,((4\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6 + 2\,\overset{(4)}{\kappa}_9)\,\overset{(2)}{\kappa}_1 - (\overset{(4)}{\kappa}_{15} + 2\,\overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_4 + \overset{(4)}{\kappa}_9)\,\overset{(2)}{\kappa}_2)) \;\&\&$$
$$\mathrm{Det}\,(2^+) == \tfrac{1}{2}\,(k^2\,(2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6) + 2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2)$$

Lagrangian

$$\overset{(2)}{\kappa}_1\,\mathcal{K}_{\alpha\beta\chi}\,\mathcal{K}^{\alpha\beta\chi} + \overset{(2)}{\kappa}_2\,\mathcal{K}^{\alpha\beta\chi}\,\mathcal{K}_{\beta\alpha\chi} + \overset{(2)}{\kappa}_3\,\mathcal{K}^{\alpha\ \ \beta}_{\ \alpha\ }\,\mathcal{K}^{\chi}_{\ \beta\chi} + \overset{(4)}{\kappa}_1\,\partial_\beta\mathcal{K}^{\delta}_{\ \chi\delta}\,\partial^\chi\mathcal{K}^{\alpha\ \ \beta}_{\ \alpha\ } +$$
$$\overset{(4)}{\kappa}_2\,\partial_\chi\mathcal{K}^{\delta}_{\ \beta\delta}\,\partial^\chi\mathcal{K}^{\alpha\ \ \beta}_{\ \alpha\ } + \overset{(4)}{\kappa}_3\,\partial_\beta\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}_{\alpha\chi}{}^{\delta} + \overset{(4)}{\kappa}_4\,\partial_\alpha\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}_{\beta\chi}{}^{\delta} + \overset{(4)}{\kappa}_6\,\partial_\beta\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}_{\chi\alpha}{}^{\delta} +$$
$$\overset{(4)}{\kappa}_7\,\partial^\chi\mathcal{K}^{\alpha\ \ \beta}_{\ \alpha\ }\,\partial_\delta\mathcal{K}_{\chi\beta}{}^{\delta} + \overset{(4)}{\kappa}_9\,\partial_\alpha\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}^{\delta}_{\ \beta\chi} + \overset{(4)}{\kappa}_{15}\,\partial_\delta\mathcal{K}_{\alpha\beta\chi}\,\partial^\delta\mathcal{K}^{\alpha\beta\chi} + \overset{(4)}{\kappa}_{16}\,\partial_\delta\mathcal{K}_{\beta\alpha\chi}\,\partial^\delta\mathcal{K}^{\alpha\beta\chi}$$

Added source term(s):	$\mathcal{K}^{\alpha\beta\chi}\ \mathcal{J}_{\alpha\beta\chi}$	
Unresolved pole(s)	# d.o.f.	Pole structure(s)
$J^P = 1^+$	6	$k^4\,(8\,\overset{(4)}{\kappa}_{15}{}^2 - (-2\,\overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_4)^2 - 4\,\overset{(4)}{\kappa}_{15}\,(\overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6 - 2\,\overset{(4)}{\kappa}_9) - 4\,(\overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6)\,\overset{(4)}{\kappa}_9) +$ $4\,(\overset{(2)}{\kappa}_1 - \overset{(2)}{\kappa}_2)\,(2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2) + 4\,k^2\,((4\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6 + 2\,\overset{(4)}{\kappa}_9)\,\overset{(2)}{\kappa}_1 - (\overset{(4)}{\kappa}_{15} + 2\,\overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_4 + \overset{(4)}{\kappa}_9)\,\overset{(2)}{\kappa}_2)$
$J^P = 1^-$	6	$k^4\,(8\,\overset{(4)}{\kappa}_{15}{}^2 + 2\,\overset{(4)}{\kappa}_{16}{}^2 - \overset{(4)}{\kappa}_7{}^2 + 4\,\overset{(4)}{\kappa}_2\,(\overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_4 - 2\,\overset{(4)}{\kappa}_9) -$ $2\,\overset{(4)}{\kappa}_{16}\,(3\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_4 + \overset{(4)}{\kappa}_7 - 2\,\overset{(4)}{\kappa}_9) + 4\,\overset{(4)}{\kappa}_{15}\,(2\,\overset{(4)}{\kappa}_{16} - 3\,\overset{(4)}{\kappa}_2 - \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_4 - \overset{(4)}{\kappa}_7 + 2\,\overset{(4)}{\kappa}_9)) +$ $2\,(2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2)\,(2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - 3\,\overset{(2)}{\kappa}_3) + 2\,k^2\,(-((-4\,\overset{(4)}{\kappa}_{15} - 2\,\overset{(4)}{\kappa}_{16} + 3\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_4 + \overset{(4)}{\kappa}_7 - 2\,\overset{(4)}{\kappa}_9)\,(2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2)) +$ $(-6\,\overset{(4)}{\kappa}_{15} - 3\,\overset{(4)}{\kappa}_{16} + 2\,(\overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_4 - 2\,\overset{(4)}{\kappa}_9))\,\overset{(2)}{\kappa}_3)$
Resolved pole(s)	# polarization(s)	Square mass / Residue
$J^P = 0^+$	1	Square mass: $\frac{2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - 3\,\overset{(2)}{\kappa}_3}{3\,\overset{(4)}{\kappa}_1 - 2\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} + 3\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6}$; Residue: $-\frac{2}{3\,\overset{(4)}{\kappa}_1 - 2\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} + 3\,\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6}$
$J^P = 0^-$	1	Square mass: $\frac{-\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2}{\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16}}$; Residue: $\frac{1}{-\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16}}$
$J^P = 2^+$	5	Square mass: $\frac{2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2}{-2\,\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6}$; Residue: $\frac{2}{2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16} - \overset{(4)}{\kappa}_3 - \overset{(4)}{\kappa}_6}$
$J^P = 2^-$	5	Square mass: $-\frac{2\,\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2}{2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16}}$; Residue: $-\frac{2}{2\,\overset{(4)}{\kappa}_{15} + \overset{(4)}{\kappa}_{16}}$
Resolved unitarity condition(s):	(Demonstrably impossible)	

FIG. 3. Output generated by *PSALTer*. Spectrograph for the unconstrained and *evidently nonunitary* theory $\aleph$ in Eq. (6). The upper matrices represent the wave operator blocks O_{J^P} from Eq. (9)—the lower matrices show the pseudoinverses $\mathsf{O}^{+}_{J^P}$. See Table I for notational details; in all spectrographs the cutoff Λ^2 is absorbed into the now-mass-dimension-two couplings $\{\overset{(2)}{\kappa}_i\}$.

simultaneously gauge- and helicity-invariant. Converting $\Pi(k)$ into this basis via the inverse of Eqs. (10a) to (10p) allows for an unambiguous identification of the quantum numbers. This final step is not yet automated in *PSALTer*, and for this reason the remaining spectrographs Figs. 6 to 8 for massless models shown in this letter do not resolve the helicity content explicitly. Nevertheless, we have performed the analysis manually to verify our claims in Sec. III regarding the spin sector J from which these modes originate.

E. Symmetries and constraints

The systematic identification of all specializations of the theory with enhanced gauge symmetry requires a different set of methodologies.

This procedure begins with the momentum-space representation of the classical equations of motion, which derive from Eq. (7):

$$\mathsf{O}(k) \cdot \mathsf{K}(k) = \frac{1}{2}\mathsf{J}(k). \tag{11}$$

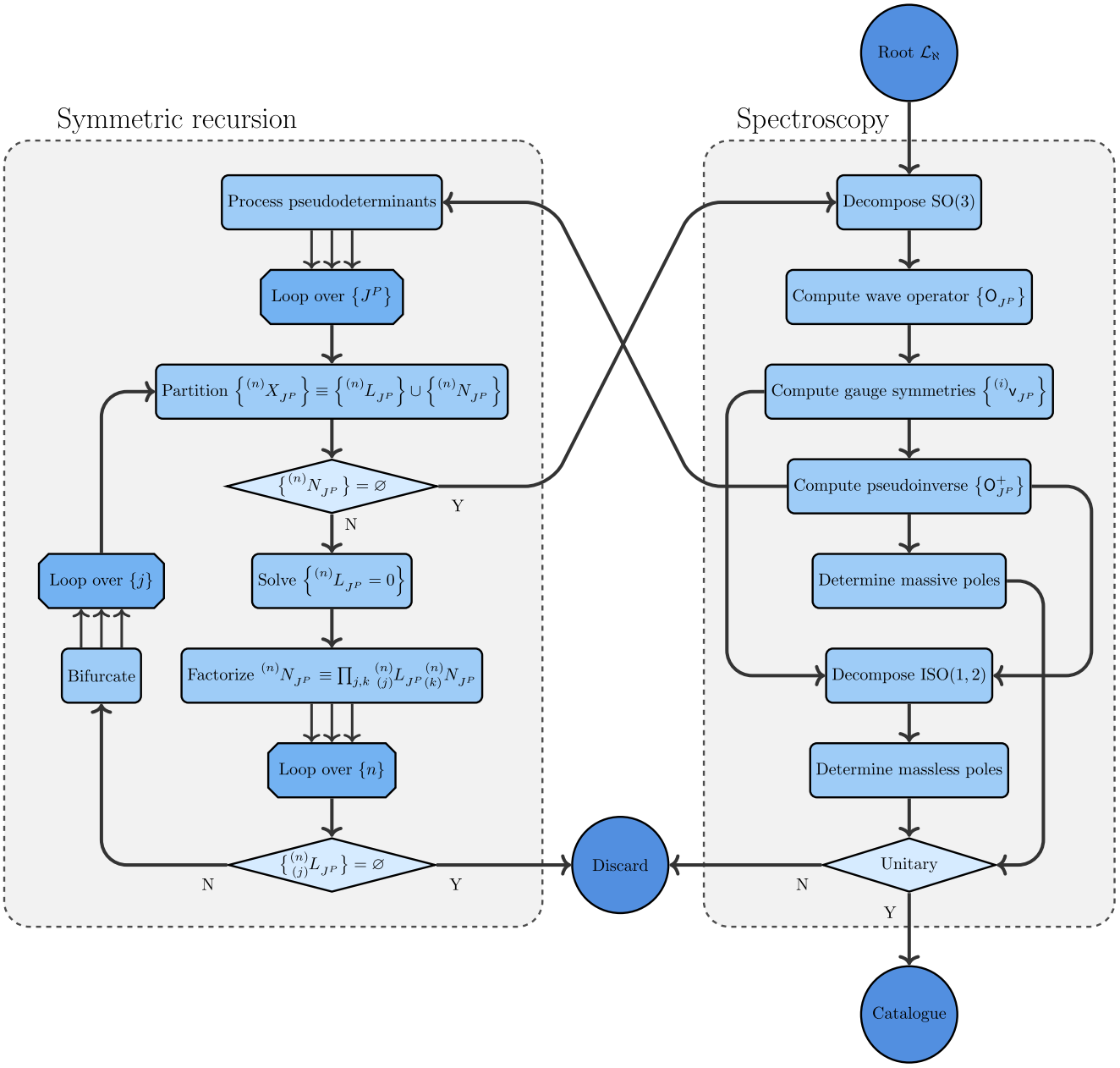


FIG. 4. The flowchart illustrates our method for systematically surveying physically motivated special cases of the general theory $\mathcal{L}_{\aleph}$ in Eq. (6). The spectroscopy provides the spin-parity decomposed wave operator, which is used by the symmetry-search algorithm. The final output is an exhaustive catalog of theories, as presented in Fig. 5 and Table II.

As can be seen in Eq. (11), a gauge invariance is manifested by the existence of principal null directions ${}^{(i)}\mathsf{v}(k)$ which satisfy $\mathsf{O}(k)\cdot{}^{(i)}\mathsf{v}(k)\equiv 0$. These null vectors generate nonphysical shifts in the field solution, $\mathsf{K}(k)\mapsto\mathsf{K}(k)+\delta\mathsf{K}(k)$, where $\delta\mathsf{K}\equiv\sum_i c_i(k){}^{(i)}\mathsf{v}(k)$ and the $c_i(x)$ are local gauge parameters. The existence of these null vectors implies that $\mathsf{O}(k)$ is singular, obstructing the direct inversion required to compute the propagator in Eq. (8). As already discussed, this issue is circumvented because the symmetry also imposes constraints on the source current $\mathsf{J}(k)$. Assuming a Hermitian wave operator, its right null eigenvectors are also left null eigenvectors. Left-multiplying the field equations in Eq. (11) by ${}^{(i)}\mathsf{v}^\dagger(k)$ thus leads to the constraints ${}^{(i)}\mathsf{v}^\dagger(k)\cdot\mathsf{J}(k)=0$, which guarantee that the would-be divergences in the propagator cancel.

F. Regularized propagator

The physical poles can then be extracted from the pseudodeterminant of a *regularized* operator $\Pi(k)\propto\det\tilde{\mathsf{O}}^{-1}(k)$ constructed using the invertible matrix

$$\tilde{\mathsf{O}}(k)\equiv\mathsf{O}(k)+\sum_i{}^{(i)}\mathsf{v}(k)\cdot{}^{(i)}\mathsf{v}^\dagger(k). \tag{12}$$

The emergence of a new gauge symmetry is encoded in the vanishing of the pseudodeterminant, $\det\tilde{\mathsf{O}}(k)$. This quantity can be expressed as a polynomial in momentum, $\det\tilde{\mathsf{O}}(k)=\sum_n{}^{(n)}Xk^n$, where the coefficients $\{{}^{(n)}X\}$ are themselves polynomials in the Lagrangian couplings. A more specialized, symmetric model is therefore defined by any set of couplings that simultaneously solves the system of equations $\{{}^{(n)}X=0\}$.

G. Symmetry bifurcation

These algebraic constraints are not guaranteed to be linear. When nonlinear constraints appear, they may factorize, causing the solution space to bifurcate into distinct branches of theories.

To systematically navigate this structure, our algorithm prioritizes any linear relationships among the couplings. This motivates a partition of the full set of constraints $\{{}^{(n)}X\}$ into linear and nonlinear subsets

$$\{{}^{(n)}X\}\equiv\{{}^{(n)}L\}\cup\{{}^{(n)}N\}. \tag{13}$$

The search for symmetric specializations is implemented in practice by leveraging the spin-parity (J^P) decomposition of the wave operator, as shown in Eq. (9). The algorithm proceeds independently on each block $\mathsf{O}_{J^P}(k)$, whose null vectors $\{{}^{(i)}\mathsf{v}_{J^P}(k)\}$ produce the set of constraint equations $\{{}^{(n)}X_{J^P}=0\}$. These are then partitioned into their linear $\{{}^{(n)}L_{J^P}=0\}$ and nonlinear $\{{}^{(n)}N_{J^P}=0\}$ components.

The linear system is addressed first, and its unique solution is substituted into the nonlinear constraints. This may cause algebraic factorization, revealing new linear conditions and thus branching points in the space of theories. This recursive process continues until no further linear factors can be extracted. Models defined solely by linear constraints are physically robust because they are independent of coupling redefinitions. Conversely, any irreducible nonlinearities that remain must be resolved by an arbitrary choice of linear "slicings," introducing ambiguity. This ambiguity is not necessarily a physical pathology: it means that the gauge symmetry is realized by a parametric condition among the couplings. Since we are not aware of any precedent for such models in nature, we are unsure about their behavior under renormalization and so defer them in our analysis.

In [2] it was found that, when applying this algorithm to the case of a totally symmetric rank-three field, the irreducibly nonlinear theories could be counted, and shown not to be predominant. For the theory in Eq. (6), however, the complexity of the branches is very much greater: we thus postpone even the counting of inherently nonlinear or "parametric" models, to future work. The overall procedure is depicted in Fig. 4.

III. RESULTS AND DISCUSSION

A. Scale of catalog

Based on the algorithm in Sec. II we extract 206 symmetric models whose degree of tuning is greater than for the root theory $\aleph$ and lesser than for the trivial empty theory $\varnothing$. The graph of all models is illustrated in Fig. 5. We allocate a letter to indicate the number of constraints ($\mathfrak{B}$ means two constraints, $\mathfrak{C}$ means three constraints, etc.) combined with a subscript to number different models. The full definition of each model is provided in Table II. While our analysis of the actual particle spectra is not exhaustive,[3] as it was in [2], we can fully profile the resulting 22 unitary cases, which are: $\mathfrak{G}_{21}$, $\mathfrak{K}_2$, $\mathfrak{J}_{11}$, $\mathfrak{K}_3$, $\mathfrak{J}_{12}$, $\mathfrak{J}_{25}$, $\mathfrak{H}_7$, $\mathfrak{J}_{33}$, $\mathfrak{H}_8$, $\mathfrak{J}_{30}$, $\mathfrak{J}_{31}$, $\mathfrak{J}_{35}$, $\mathfrak{J}_6$, $\mathfrak{H}_{33}$, $\mathfrak{J}_{14}$, $\mathfrak{J}_{26}$, $\mathfrak{H}_{27}$, $\mathfrak{H}_{28}$, $\mathfrak{J}_{17}$, $\mathfrak{H}_{32}$, $\mathfrak{J}_{16}$, and $\mathfrak{J}_{21}$. As key examples, the complete spectrographs of $\mathfrak{K}_2$, $\mathfrak{K}_3$ and $\mathfrak{J}_{12}$ are illustrated in Figs. 6 to 8, respectively.

To give our discussion of these results some context, we will focus mostly on the implications for theories with *torsion*, including a brief literature review of such models. Despite this focus, it should nonetheless be borne in mind (see Sec. I) that the IR limit in Eq. (6) is relevant for any theory of a pair-antisymmetric rank-three field, of which torsion is just one example.

B. Nonpropagating torsion

Before discussing the results in detail, it is helpful to review the current status of torsion in the literature. This is important, as we imagine the IR limits derived from Eq. (6)

[3]The small fraction of models for which unitarity conditions could not be assessed was excluded due to their complex structure, involving numerous parameters and multiparticle (more than just two) propagation.

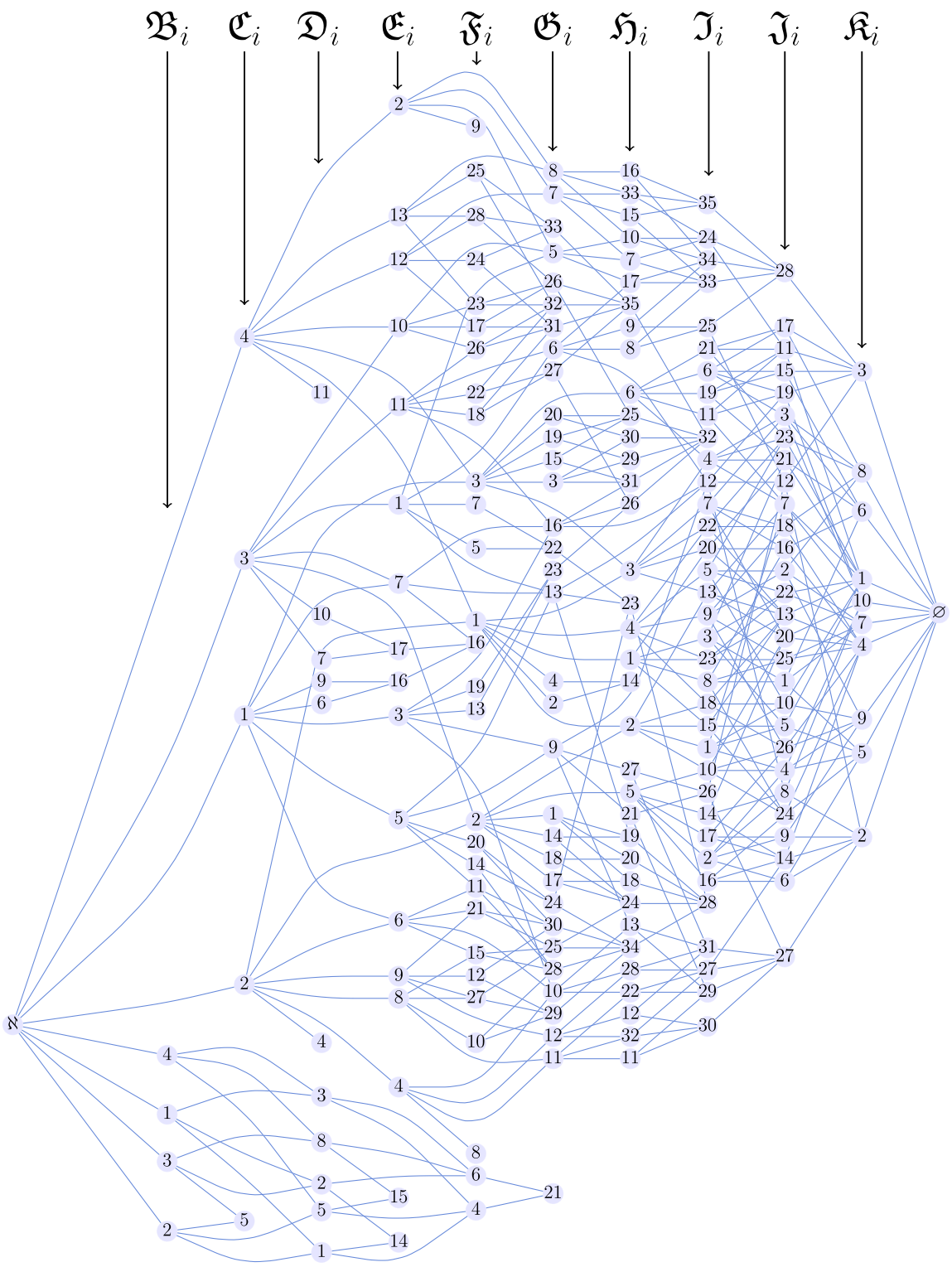


FIG. 5. The complete classification of models for a pair-antisymmetric rank-three field. Each vertex corresponds to a separately defined theory, derived by imposing progressively more linear constraints (progressing from left to right) on the unconstrained theory $\aleph$ of Eq. (6). This process terminates at the theory $\varnothing$, for which $\mathcal{L}_{\varnothing} \equiv 0$. The connections represent the constraints that define a daughter model in terms of its parent—we show only connections spanning the fewest possible generations. A complete listing of all models is provided in Table II.

TABLE II. This table provides a complete catalog of all models depicted in the hierarchy of Fig. 5. For each entry, the second column specifies the defining constraints as vanishing linear combinations of the parameters in Eq. (6). The third column outlines the additional conditions that result in more specialized, symmetric theories. For the consistent theories $\mathfrak{K}_2$, $\mathfrak{K}_3$ and $\mathfrak{J}_{12}$, the corresponding spectrographs are provided in Figs. 6 to 8.

Model	Definition	Deconfliction
$\mathfrak{K}$	$\cdots$	$\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_2=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-\overset{4}{\kappa}_3-\overset{4}{\kappa}_6=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[3\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2-3\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_6+4\overset{4}{\kappa}_9=0\wedge -4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4-4\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_6+4\overset{4}{\kappa}_9=0\wedge\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\tfrac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_2=0\right]\vee\left[\overset{4}{\kappa}_3+\overset{4}{\kappa}_4+\tfrac{3}{2}\overset{4}{\kappa}_7-2\overset{4}{\kappa}_9=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[\overset{4}{\kappa}_3+\overset{4}{\kappa}_4+\tfrac{3}{2}\overset{4}{\kappa}_7-2\overset{4}{\kappa}_9=0\wedge 4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2-3\overset{2}{\kappa}_3=0\right]$
$\mathfrak{B}_1$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3-\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4-2\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\right]\vee\left[3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{B}_2$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_4-4\overset{4}{\kappa}_9=0\right]\vee\left[\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3+\tfrac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{B}_3$	$-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+2\overset{4}{\kappa}_9=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge 6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\right]\vee\left[8\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge 6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_3=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{B}_4$	$3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge -\frac{2}{3}\overset{2}{\kappa}_1 - \frac{1}{3}\overset{2}{\kappa}_2 + \overset{2}{\kappa}_3 = 0$	$\left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 - \overset{2}{\kappa}_2 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right] \vee \left[\overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right] \vee \left[4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - \overset{4}{\kappa}_7 = 0 \wedge 6\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_{16} - 9\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 - 2\overset{4}{\kappa}_9 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge 3\overset{4}{\kappa}_1 + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + 4\overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right] \vee \left[-6\overset{4}{\kappa}_1 + 8\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge 3\overset{4}{\kappa}_1 - 3\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 - \overset{2}{\kappa}_2 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge 6\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - 2\overset{4}{\kappa}_4 + 4\overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right]$
$\mathfrak{C}_1$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 + \overset{4}{\kappa}_6 = 0 \wedge \overset{4}{\kappa}_{15} + \frac{1}{2}\overset{4}{\kappa}_{16} - \frac{1}{4}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee 4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \vee \left[3\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{16} - \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 + \overset{4}{\kappa}_7 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0\right] \vee \left[6\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 + 4\overset{4}{\kappa}_7 = 0 \wedge 4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 + 3\overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{C}_2$	$2\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 + \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_6 = 0 \wedge \overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge -\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0$	$\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \vee \left[-6\overset{4}{\kappa}_1 + 8\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_1 - \overset{2}{\kappa}_3 = 0\right] \vee \left[2\overset{4}{\kappa}_{16} - \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[8\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[3\overset{4}{\kappa}_{16} - 3\overset{4}{\kappa}_2 - \overset{4}{\kappa}_3 - 2\overset{4}{\kappa}_4 - 2\overset{4}{\kappa}_7 = 0 \wedge 12\overset{4}{\kappa}_{15} - 12\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + 4\overset{4}{\kappa}_4 + \overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_1 - \overset{2}{\kappa}_3 = 0\right] \vee \left[6\overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - 4\overset{4}{\kappa}_4 - \overset{4}{\kappa}_7 = 0 \wedge 12\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_3 + 4\overset{4}{\kappa}_4 + 7\overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{C}_3$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge \frac{3}{2}\overset{4}{\kappa}_{15} + \frac{3}{4}\overset{4}{\kappa}_{16} - \frac{1}{2}\overset{4}{\kappa}_3 - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_6 = 0 \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[\overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_4 + 2\overset{4}{\kappa}_6 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[18\overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - 9\overset{4}{\kappa}_4 - 2\overset{4}{\kappa}_6 = 0 \wedge 36\overset{4}{\kappa}_{15} - 22\overset{4}{\kappa}_3 - 9\overset{4}{\kappa}_4 + 14\overset{4}{\kappa}_6 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{C}_4$	$-4\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} + 6\overset{4}{\kappa}_2 + \overset{4}{\kappa}_7 = 0 \wedge -3\overset{4}{\kappa}_{15} - \frac{3}{2}\overset{4}{\kappa}_{16} + \frac{9}{2}\overset{4}{\kappa}_2 - \frac{1}{2}\overset{4}{\kappa}_3 - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge -\frac{2}{3}\overset{2}{\kappa}_1 - \frac{1}{3}\overset{2}{\kappa}_2 + \overset{2}{\kappa}_3 = 0$	$3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 - \overset{2}{\kappa}_2 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_6 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right] \vee \left[9\overset{4}{\kappa}_{16} - 9\overset{4}{\kappa}_2 + 5\overset{4}{\kappa}_3 - 4\overset{4}{\kappa}_6 = 0 \wedge 36\overset{4}{\kappa}_{15} - 36\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + 9\overset{4}{\kappa}_4 + 2\overset{4}{\kappa}_6 = 0 \wedge \overset{2}{\kappa}_1 - \overset{2}{\kappa}_2 = 0\right] \vee \left[18\overset{4}{\kappa}_2 - 10\overset{4}{\kappa}_3 - 9\overset{4}{\kappa}_4 + 8\overset{4}{\kappa}_6 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 + \overset{4}{\kappa}_6 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{C}_5$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+2\overset{4}{\kappa}_9=0\right]\vee\left[\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[12\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{D}_1$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4-2\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\right]\vee\left[\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_4-4\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{D}_2$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+2\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{D}_3$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+4\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{D}_4$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\overset{4}{\kappa}_3+\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$\left[6\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-4\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[9\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge 6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_3=0\right]$
$\mathfrak{D}_5$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+4\overset{4}{\kappa}_9=0\right]\vee\left[\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_1-12\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{D}_6$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+\overset{4}{\kappa}_6=0\wedge-\frac{1}{4\overset{4}{\kappa}_4}+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[18\overset{4}{\kappa}_2-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{D}_7$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_7=0\wedge-\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge 18\overset{4}{\kappa}_{15}-5\overset{4}{\kappa}_3+4\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{D}_8$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+2\overset{4}{\kappa}_9=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge 6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}-\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_1+6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[8\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{D}_9$	$-4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[-\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{5}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge 8\overset{4}{\kappa}_{15}+4\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{D}_{10}$	$-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}+\frac{3}{4}\overset{4}{\kappa}_{16}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[34\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}-16\overset{4}{\kappa}_{16}+9\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{D}_{11}$	$3\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-3\overset{4}{\kappa}_{15}-\frac{3}{2}\overset{4}{\kappa}_{16}+\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge-\frac{2}{3}\overset{2}{\kappa}_1-\frac{1}{3}\overset{2}{\kappa}_2+\overset{2}{\kappa}_3=0$	$\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_2=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[3\overset{4}{\kappa}_1-20\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_{16}+21\overset{4}{\kappa}_2=0\wedge 18\overset{4}{\kappa}_1-8\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_{16}+14\overset{4}{\kappa}_3+7\overset{4}{\kappa}_4=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\right]\vee\left[12\overset{4}{\kappa}_1-8\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_2+9\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_1-40\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+42\overset{4}{\kappa}_2-9\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1-\overset{2}{\kappa}_2=0\right]$
$\mathfrak{E}_1$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee 3\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3-\overset{4}{\kappa}_6=0\vee\left[9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-4\overset{4}{\kappa}_4=0\wedge 9\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_3+8\overset{4}{\kappa}_6=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\right]$
$\mathfrak{E}_2$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-\frac{9}{2}\overset{4}{\kappa}_{15}+\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[9\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge 9\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+5\overset{4}{\kappa}_3-4\overset{4}{\kappa}_6=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3-\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[24\overset{4}{\kappa}_{15}-18\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 27\overset{4}{\kappa}_{15}-18\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{E}_3$	$3\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge 3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge \frac{3}{4}\overset{4}{\kappa}_1 + \frac{3}{4}\overset{4}{\kappa}_2 + \frac{1}{2}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee \overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \vee \left[3\overset{4}{\kappa}_1 - 20\overset{4}{\kappa}_{15} - 10\overset{4}{\kappa}_{16} + 21\overset{4}{\kappa}_2 = 0 \wedge 6\overset{4}{\kappa}_1 - 12\overset{4}{\kappa}_{15} - 6\overset{4}{\kappa}_{16} - 7\overset{4}{\kappa}_7 = 0\right] \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0\right]$
$\mathfrak{E}_4$	$-6\overset{4}{\kappa}_1 + 8\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge 3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge 3\overset{4}{\kappa}_1 - 3\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge -\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge -\overset{2}{\kappa}_1 + \overset{2}{\kappa}_3 = 0$	$\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \vee \left[12\overset{4}{\kappa}_1 - 8\overset{4}{\kappa}_{15} + 5\overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + 9\overset{4}{\kappa}_3 = 0 \wedge 4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - \overset{4}{\kappa}_7 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[\overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[24\overset{4}{\kappa}_1 - 34\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + 24\overset{4}{\kappa}_2 + 18\overset{4}{\kappa}_3 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{E}_5$	$-\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge 3\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 + \overset{4}{\kappa}_6 = 0 \wedge \frac{3}{2}\overset{4}{\kappa}_{15} - \frac{1}{4}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 = 0 \wedge \overset{2}{\kappa}_2 = 0$	$2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_4 = 0 \vee \overset{4}{\kappa}_{15} = 0 \vee 6\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \vee \left[3\overset{4}{\kappa}_1 - 6\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[3\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \wedge 3\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_7 = 0\right] \vee \left[24\overset{4}{\kappa}_{15} - 18\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge 6\overset{4}{\kappa}_{15} - 6\overset{4}{\kappa}_2 - \overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{E}_6$	$-2\overset{4}{\kappa}_{16} + \overset{4}{\kappa}_4 = 0 \wedge 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge \overset{4}{\kappa}_{15} + \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 = 0 \wedge \overset{2}{\kappa}_2 = 0$	$\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_3 = 0 \vee \left[3\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} + 3\overset{4}{\kappa}_2 + 2\overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0\right] \vee \left[8\overset{4}{\kappa}_{15} + 5\overset{4}{\kappa}_{16} - 9\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 = 0 \wedge 4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - \overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{E}_7$	$-2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge \frac{1}{2}\overset{4}{\kappa}_{15} + \frac{1}{4}\overset{4}{\kappa}_{16} + \frac{1}{2}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{E}_8$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge 6\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_3 + \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_6 = 0 \wedge 3\overset{4}{\kappa}_{15} + \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 = 0 \wedge \overset{2}{\kappa}_2 = 0$	$\overset{4}{\kappa}_{15} = 0 \vee 4\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_4 = 0 \vee 12\overset{4}{\kappa}_{15} - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \vee \left[6\overset{4}{\kappa}_1 - 12\overset{4}{\kappa}_{15} + 6\overset{4}{\kappa}_2 + 4\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[6\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_3 + 2\overset{4}{\kappa}_4 = 0 \wedge \overset{4}{\kappa}_7 = 0\right] \vee \left[6\overset{4}{\kappa}_{15} - 9\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + 2\overset{4}{\kappa}_4 = 0 \wedge 6\overset{4}{\kappa}_2 + \overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{E}_9$	$8\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge -2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge -3\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 = 0 \wedge \overset{2}{\kappa}_2 = 0$	$\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \vee 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_3 = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee \left[\overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[34\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} - 18\overset{4}{\kappa}_3 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0\right] \vee \left[8\overset{4}{\kappa}_{15} - 5\overset{4}{\kappa}_{16} + 9\overset{4}{\kappa}_2 - 9\overset{4}{\kappa}_3 = 0 \wedge 4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 6\overset{4}{\kappa}_2 - \overset{4}{\kappa}_7 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{E}_{10}$	$-\overset{4}{\kappa}_{15} - \frac{1}{2}\overset{4}{\kappa}_{16} + \overset{4}{\kappa}_2 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge \frac{3}{2}\overset{4}{\kappa}_{15} + \frac{3}{4}\overset{4}{\kappa}_{16} - \frac{1}{2}\overset{4}{\kappa}_3 - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_6 = 0 \vee 3\overset{4}{\kappa}_1 + \overset{4}{\kappa}_{15} + \frac{1}{2}\overset{4}{\kappa}_{16} + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + 7\overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - 4\overset{4}{\kappa}_4 = 0 \wedge 18\overset{4}{\kappa}_{15} - 9\overset{4}{\kappa}_{16} - 10\overset{4}{\kappa}_3 + 8\overset{4}{\kappa}_6 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{E}_{11}$	$3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge \frac{3}{2}\overset{4}{\kappa}_{15} + \frac{3}{4}\overset{4}{\kappa}_{16} - \frac{1}{2}\overset{4}{\kappa}_3 - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee \overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[3\overset{4}{\kappa}_1 - 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0\right] \vee \left[24\overset{4}{\kappa}_1 - 34\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + 24\overset{4}{\kappa}_2 + 18\overset{4}{\kappa}_3 = 0 \wedge 6\overset{4}{\kappa}_1 - 4\overset{4}{\kappa}_{15} + 16\overset{4}{\kappa}_{16} + 6\overset{4}{\kappa}_2 - 9\overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{E}_{12}$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge 6\overset{4}{\kappa}_2 + \overset{4}{\kappa}_7 = 0 \wedge \frac{9}{2}\overset{4}{\kappa}_2 - \frac{1}{2}\overset{4}{\kappa}_3 - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0$	$\overset{4}{\kappa}_2 = 0 \vee 3\overset{4}{\kappa}_1 + 3\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \vee \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \vee \left[\overset{4}{\kappa}_{15} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[18\overset{4}{\kappa}_2 - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \wedge 18\overset{4}{\kappa}_2 - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_6 = 0\right] \vee \left[6\overset{4}{\kappa}_{15} - 9\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 + 2\overset{4}{\kappa}_4 = 0 \wedge 18\overset{4}{\kappa}_{15} + 9\overset{4}{\kappa}_2 - 5\overset{4}{\kappa}_3 + 4\overset{4}{\kappa}_6 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{E}_{13}$	$-2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge -4\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} + 6\overset{4}{\kappa}_2 + \overset{4}{\kappa}_7 = 0 \wedge -3\overset{4}{\kappa}_{15} - \frac{3}{2}\overset{4}{\kappa}_{16} + \frac{9}{2}\overset{4}{\kappa}_2 - \frac{1}{2}\overset{4}{\kappa}_3 - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \vee \overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee \left[\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[-\frac{10}{9}\overset{4}{\kappa}_{15} - \frac{5}{9}\overset{4}{\kappa}_{16} + \overset{4}{\kappa}_2 = 0 \wedge 4\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0\right] \vee \left[8\overset{4}{\kappa}_{15} - 5\overset{4}{\kappa}_{16} + 9\overset{4}{\kappa}_2 - 9\overset{4}{\kappa}_3 = 0 \wedge 40\overset{4}{\kappa}_{15} + 2\overset{4}{\kappa}_{16} - 36\overset{4}{\kappa}_2 + 9\overset{4}{\kappa}_4 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{E}_{14}$	$\overset{4}{\kappa}_{15} = 0 \wedge \overset{4}{\kappa}_{16} = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge \overset{2}{\kappa}_1 = 0 \wedge \overset{2}{\kappa}_2 = 0$	$\left[\overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[\overset{4}{\kappa}_7 = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 - 2\overset{4}{\kappa}_9 = 0\right] \vee \left[2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{4}{\kappa}_3 + 2\overset{4}{\kappa}_9 = 0\right] \vee \left[4\overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 = 0 \wedge 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0\right] \vee \left[6\overset{4}{\kappa}_2 + \overset{4}{\kappa}_7 = 0 \wedge 9\overset{4}{\kappa}_2 - \overset{4}{\kappa}_3 - \overset{4}{\kappa}_4 + 2\overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{E}_{15}$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge \overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0$	$\left[\overset{4}{\kappa}_{15} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{4}{\kappa}_3 + 2\overset{4}{\kappa}_9 = 0\right] \vee \left[\overset{4}{\kappa}_7 = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 - 2\overset{4}{\kappa}_9 = 0\right] \vee \left[6\overset{4}{\kappa}_1 - \overset{4}{\kappa}_7 = 0 \wedge 9\overset{4}{\kappa}_1 + \overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 - 2\overset{4}{\kappa}_9 = 0\right] \vee \left[12\overset{4}{\kappa}_{15} - 4\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge 3\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_3 - \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{E}_{16}$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge 2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge \frac{1}{2}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0$	$\overset{4}{\kappa}_7 = 0 \vee \left[\overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[\overset{4}{\kappa}_{15} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{E}_{17}$	$2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge \overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge \overset{4}{\kappa}_7 = 0 \wedge -\frac{1}{2\overset{4}{\kappa}_3} - \frac{1}{2}\overset{4}{\kappa}_4 + \overset{4}{\kappa}_9 = 0 \wedge 2\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0$	$2\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \vee \left[\overset{4}{\kappa}_{15} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[\overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[\overset{4}{\kappa}_1 + \overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$
$\mathfrak{F}_1$	$4\overset{4}{\kappa}_{15} + \frac{1}{2}\overset{4}{\kappa}_{16} - \frac{9}{2}\overset{4}{\kappa}_2 + \frac{1}{2}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge -\frac{9}{4}\overset{4}{\kappa}_{16} + \frac{9}{4}\overset{4}{\kappa}_2 - \frac{5}{4}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge -4\overset{4}{\kappa}_{15} - 2\overset{4}{\kappa}_{16} + 6\overset{4}{\kappa}_2 + \overset{4}{\kappa}_7 = 0 \wedge -\overset{4}{\kappa}_{15} - \frac{5}{4}\overset{4}{\kappa}_{16} + \frac{9}{4}\overset{4}{\kappa}_2 - \frac{1}{4}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge -\overset{2}{\kappa}_1 + \overset{2}{\kappa}_2 = 0 \wedge -\overset{2}{\kappa}_1 + \overset{2}{\kappa}_3 = 0$	$\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \vee 12\overset{4}{\kappa}_1 - 8\overset{4}{\kappa}_{15} + 5\overset{4}{\kappa}_{16} + 3\overset{4}{\kappa}_2 + 9\overset{4}{\kappa}_3 = 0 \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[8\overset{4}{\kappa}_{15} + 5\overset{4}{\kappa}_{16} - 9\overset{4}{\kappa}_2 + \overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_1 = 0\right] \vee \left[8\overset{4}{\kappa}_{15} - 5\overset{4}{\kappa}_{16} + 9\overset{4}{\kappa}_2 - 9\overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_1 = 0\right]$
$\mathfrak{F}_2$	$-\frac{1}{2\overset{4}{\kappa}_{15}} - \frac{7}{4}\overset{4}{\kappa}_{16} + \frac{1}{2}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_4 = 0 \wedge \frac{9}{4}\overset{4}{\kappa}_{15} - \frac{9}{8}\overset{4}{\kappa}_{16} - \frac{5}{4}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_6 = 0 \wedge 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + \overset{4}{\kappa}_7 = 0 \wedge \frac{5}{4}\overset{4}{\kappa}_{15} - \frac{1}{8}\overset{4}{\kappa}_{16} - \frac{1}{4}\overset{4}{\kappa}_3 + \overset{4}{\kappa}_9 = 0 \wedge \overset{2}{\kappa}_1 = 0 \wedge \overset{2}{\kappa}_2 = 0$	$\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} = 0 \vee 2\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_3 = 0 \vee 2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} = 0 \vee 34\overset{4}{\kappa}_{15} - \overset{4}{\kappa}_{16} - 18\overset{4}{\kappa}_3 = 0 \vee \left[2\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} - 2\overset{4}{\kappa}_2 = 0 \wedge \overset{2}{\kappa}_3 = 0\right] \vee \left[24\overset{4}{\kappa}_1 - 34\overset{4}{\kappa}_{15} + \overset{4}{\kappa}_{16} + 24\overset{4}{\kappa}_2 + 18\overset{4}{\kappa}_3 = 0 \wedge \overset{2}{\kappa}_3 = 0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{F}_3$	$16\overset{4}{\kappa}_{15}+8\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 18\overset{4}{\kappa}_{15}+9\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge -4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 5\overset{4}{\kappa}_{15}+\frac{5}{2}\overset{4}{\kappa}_{16}-\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$3\overset{4}{\kappa}_1-20\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_{16}+21\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 10\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2=0\vee\left[8\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_4$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_1+6\overset{4}{\kappa}_2+4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+2\overset{4}{\kappa}_9=0\right]\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+4\overset{4}{\kappa}_9=0\right]$
$\mathfrak{F}_5$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_7=0\wedge-\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge 5\overset{4}{\kappa}_3-4\overset{4}{\kappa}_6=0\right]$
$\mathfrak{F}_6$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\left[3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4+4\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_1+6\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_1+9\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+2\overset{4}{\kappa}_9=0\right]$
$\mathfrak{F}_7$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_4=0\right]$
$\mathfrak{F}_8$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-6\overset{4}{\kappa}_1+6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[4\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\right]\vee\left[8\overset{4}{\kappa}_1-11\overset{4}{\kappa}_{15}+8\overset{4}{\kappa}_2+6\overset{4}{\kappa}_3=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_9$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-\frac{9}{2}\overset{4}{\kappa}_{15}+\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$\left[4\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_1-14\overset{4}{\kappa}_{15}+14\overset{4}{\kappa}_2-3\overset{4}{\kappa}_4=0\right]\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_2=0\wedge 18\overset{4}{\kappa}_1-12\overset{4}{\kappa}_{15}+14\overset{4}{\kappa}_3+7\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{10}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-\overset{4}{\kappa}_3+\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_4=0\vee 4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\vee\left[6\overset{4}{\kappa}_1+6\overset{4}{\kappa}_2+4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_7=0\right]\vee\left[9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{11}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\left[3\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\right]\vee\left[13\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{12}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 6\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\right]\vee\left[\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2-3\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{F}_{13}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{3}{4}\overset{4}{\kappa}_1+\frac{3}{4}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1-7\overset{4}{\kappa}_7=0\right]$
$\mathfrak{F}_{14}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-\overset{4}{\kappa}_3-\overset{4}{\kappa}_4+\overset{4}{\kappa}_6=0\wedge-\frac{1}{4\overset{4}{\kappa}_4}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\vee\overset{4}{\kappa}_4=0\vee\left[3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[18\overset{4}{\kappa}_2-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{15}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge 4\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\left[3\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_{15}+9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{16}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{17}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_7=0\wedge-\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee 3\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge 18\overset{4}{\kappa}_{15}-5\overset{4}{\kappa}_3+4\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{18}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge-\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+4\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_1-12\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_2-3\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{19}$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 12\overset{4}{\kappa}_1-5\overset{4}{\kappa}_7=0\right]$
$\mathfrak{F}_{20}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-6\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[5\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_2=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{21}$	$-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[-\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{5}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge 8\overset{4}{\kappa}_{15}+4\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{22}$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}+\frac{3}{4}\overset{4}{\kappa}_{16}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[34\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}-16\overset{4}{\kappa}_{16}+9\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{23}$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}+\frac{3}{4}\overset{4}{\kappa}_{16}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[34\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}-16\overset{4}{\kappa}_{16}+9\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{24}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\right]\vee\left[4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_1-12\overset{4}{\kappa}_{15}+14\overset{4}{\kappa}_2-3\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{F}_{25}$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge-\frac{9}{2}\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}-\frac{3}{2}\overset{4}{\kappa}_{16}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{18}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\right]\vee\left[9\overset{4}{\kappa}_1-8\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}+9\overset{4}{\kappa}_3=0\wedge36\overset{4}{\kappa}_1+40\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}+9\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{26}$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge3\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}+\frac{3}{4}\overset{4}{\kappa}_{16}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\right]\vee\left[24\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+13\overset{4}{\kappa}_{16}+18\overset{4}{\kappa}_3=0\wedge6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+19\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{F}_{27}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge12\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{F}_{28}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge4\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_1$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{9}{4}\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{8}\overset{4}{\kappa}_{15}-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{8}\overset{4}{\kappa}_{15}-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3=0\vee11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[8\overset{4}{\kappa}_1-11\overset{4}{\kappa}_{15}+8\overset{4}{\kappa}_2+6\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_2$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{9}{2}\overset{4}{\kappa}_{15}-\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-\frac{9}{4}\overset{4}{\kappa}_{15}+\frac{9}{4}\overset{4}{\kappa}_2-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-\frac{9}{4}\overset{4}{\kappa}_{15}+\frac{9}{4}\overset{4}{\kappa}_2-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$4\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[13\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2-3\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_3$	$\frac{1}{7}\overset{4}{\kappa}_1-\frac{20}{21}\overset{4}{\kappa}_{15}-\frac{10}{21}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge\frac{18}{7}\overset{4}{\kappa}_1-\frac{8}{7}\overset{4}{\kappa}_{15}-\frac{4}{7}\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+\frac{6}{7}\overset{4}{\kappa}_{15}+\frac{3}{7}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\frac{12}{7}\overset{4}{\kappa}_{15}+\frac{6}{7}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{9}{14}\overset{4}{\kappa}_1+\frac{5}{7}\overset{4}{\kappa}_{15}+\frac{5}{14}\overset{4}{\kappa}_{16}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[9\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}+7\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_4$	$\frac{4}{3}\overset{4}{\kappa}_1-\frac{8}{9}\overset{4}{\kappa}_{15}+\frac{5}{9}\overset{4}{\kappa}_{16}+\frac{1}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge-\frac{2}{3}\overset{4}{\kappa}_1+\frac{40}{9}\overset{4}{\kappa}_{15}+\frac{2}{9}\overset{4}{\kappa}_{16}-\frac{14}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1-\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{14}{9}\overset{4}{\kappa}_{16}+\frac{8}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge-4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1-\frac{11}{9}\overset{4}{\kappa}_{15}-\frac{10}{9}\overset{4}{\kappa}_{16}+\frac{7}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee\left[3\overset{4}{\kappa}_1-20\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_{16}+21\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_5$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee3\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3-\overset{4}{\kappa}_6=0\vee3\overset{4}{\kappa}_1+\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[9\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-4\overset{4}{\kappa}_4=0\wedge9\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_3+8\overset{4}{\kappa}_6=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\right]$
$\mathfrak{G}_6$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\vee\left[8\overset{4}{\kappa}_1-11\overset{4}{\kappa}_{15}+8\overset{4}{\kappa}_2+6\overset{4}{\kappa}_3=0\wedge2\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_2-3\overset{4}{\kappa}_4=0\right]\vee\left[\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{G}_7$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-2\overset{4}{\kappa}_4=0\wedge 9\overset{4}{\kappa}_2-5\overset{4}{\kappa}_3+4\overset{4}{\kappa}_6=0\right]\vee\left[18\overset{4}{\kappa}_2-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 18\overset{4}{\kappa}_2-\overset{4}{\kappa}_3-\overset{4}{\kappa}_6=0\right]$
$\mathfrak{G}_8$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-\frac{9}{2}\overset{4}{\kappa}_{15}+\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2-3\overset{4}{\kappa}_3=0\wedge\frac{14}{3}\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\right]\vee\left[5\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\right]$
$\mathfrak{G}_9$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{3}{4}\overset{4}{\kappa}_1+\frac{3}{4}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$3\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1-18\overset{4}{\kappa}_{15}-7\overset{4}{\kappa}_7=0\right]\vee\left[\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\right]$
$\mathfrak{G}_{10}$	$\frac{3}{2}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge\frac{3}{2}\overset{4}{\kappa}_1-\overset{4}{\kappa}_{16}+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[3\overset{4}{\kappa}_1-20\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_{16}+21\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1-12\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_{16}-7\overset{4}{\kappa}_7=0\right]\vee\left[3\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_2=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\right]$
$\mathfrak{G}_{11}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-6\overset{4}{\kappa}_1+12\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_2-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_1-3\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee 3\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\right]\vee\left[4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+4\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_7=0\right]$
$\mathfrak{G}_{12}$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 8\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[9\overset{4}{\kappa}_1-8\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}+9\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{16}-\overset{4}{\kappa}_7=0\right]\vee\left[34\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\right]$
$\mathfrak{G}_{13}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{3}{4}\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{14}$	$-\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{15}$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_{15}+\frac{1}{4}\overset{4}{\kappa}_{16}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{16}$	$\overset{4}{\kappa}_1-\frac{2}{3}\overset{4}{\kappa}_{15}-\frac{1}{3}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_{15}+\frac{1}{4}\overset{4}{\kappa}_{16}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{17}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{2}\overset{4}{\kappa}_{15}-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+4\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_3=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{G}_{18}$	$-\frac{17}{9}\overset{4}{\kappa}_{15}+\frac{1}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge\frac{4}{9}\overset{4}{\kappa}_{15}-\frac{16}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge -\frac{1}{9\overset{4}{\kappa}_{15}}-\frac{19}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge \frac{7}{9}\overset{4}{\kappa}_{15}-\frac{1}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{19}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge -18\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge -18\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge -\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}+9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{20}$	$-\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{5}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge -4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge -2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{8}{3}\overset{4}{\kappa}_{15}+\frac{4}{3}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\left[\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{21}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\left[\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]\vee\left[2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+2\overset{4}{\kappa}_9=0\right]\vee\left[4\overset{4}{\kappa}_3-\overset{4}{\kappa}_4=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\right]\vee\left[6\overset{4}{\kappa}_1-\overset{4}{\kappa}_7=0\wedge 9\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_4-2\overset{4}{\kappa}_9=0\right]$
$\mathfrak{G}_{22}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge -\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{23}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_7=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{24}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_7=0\vee\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{25}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_7=0\vee\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{26}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge -\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\vee\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{27}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge -\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\vee\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{28}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_4=0\wedge -\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3=0\vee\left[\frac{3}{2}\overset{4}{\kappa}_1+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{29}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge -4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{30}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge -\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[5\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_2=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{G}_{31}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge 3\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge -\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_1-12\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{G}_{32}$	$2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 2\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge -2\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge -\frac{3}{2}\overset{4}{\kappa}_1-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+18\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_3=0\wedge\frac{32}{9}\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{G}_{33}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge -6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge -\frac{9}{2}\overset{4}{\kappa}_1-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_1$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_{15}-\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{2}\overset{4}{\kappa}_{15}+\frac{9}{4}\overset{4}{\kappa}_2-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}+\frac{9}{4}\overset{4}{\kappa}_2-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee 4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0$
$\mathfrak{H}_2$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge -\frac{1}{2\overset{4}{\kappa}_{15}}-\frac{7}{4}\overset{4}{\kappa}_{16}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{9}{8}\overset{4}{\kappa}_{16}-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{5}{4}\overset{4}{\kappa}_{15}-\frac{1}{8}\overset{4}{\kappa}_{16}-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 24\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+13\overset{4}{\kappa}_{16}+18\overset{4}{\kappa}_3=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_3=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 34\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}-18\overset{4}{\kappa}_3=0$
$\mathfrak{H}_3$	$8\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge -2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge 10\overset{4}{\kappa}_{15}+4\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge -4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 3\overset{4}{\kappa}_1-20\overset{4}{\kappa}_{15}-10\overset{4}{\kappa}_{16}+21\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 10\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2=0$
$\mathfrak{H}_4$	$-\frac{8}{9}\overset{4}{\kappa}_{15}+\frac{5}{9}\overset{4}{\kappa}_{16}-\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\frac{40}{9}\overset{4}{\kappa}_{15}+\frac{2}{9}\overset{4}{\kappa}_{16}-4\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge -\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{14}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge -4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge -\frac{11}{9}\overset{4}{\kappa}_{15}-\frac{10}{9}\overset{4}{\kappa}_{16}+2\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\vee 10\overset{4}{\kappa}_{15}+5\overset{4}{\kappa}_{16}-9\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{H}_5$	$\frac{4}{3}\overset{4}{\kappa}_1-\frac{17}{9}\overset{4}{\kappa}_{15}+\frac{1}{18}\overset{4}{\kappa}_{16}+\frac{4}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge -\frac{2}{3}\overset{4}{\kappa}_1+\frac{4}{9}\overset{4}{\kappa}_{15}-\frac{16}{9}\overset{4}{\kappa}_{16}-\frac{2}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1-\frac{1}{9}\overset{4}{\kappa}_{15}-\frac{19}{18}\overset{4}{\kappa}_{16}+\frac{5}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\frac{7}{9}\overset{4}{\kappa}_{15}-\frac{1}{9}\overset{4}{\kappa}_{16}+\frac{1}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}-2\overset{4}{\kappa}_2=0\vee 3\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}+3\overset{4}{\kappa}_2=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0$
$\mathfrak{H}_6$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 24\overset{4}{\kappa}_{15}-18\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 27\overset{4}{\kappa}_{15}-18\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge -6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{15}{2}\overset{4}{\kappa}_{15}-\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$13\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_2=0\vee 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0\vee 5\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_2=0$
$\mathfrak{H}_7$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_7=0\wedge -\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee 3\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\vee\left[\overset{4}{\kappa}_3+2\overset{4}{\kappa}_4=0\wedge 5\overset{4}{\kappa}_3-4\overset{4}{\kappa}_6=0\right]$
$\mathfrak{H}_8$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge -\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_2=0\vee\left[\frac{4}{3}\overset{4}{\kappa}_1+\frac{4}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_2-3\overset{4}{\kappa}_4=0\right]$
$\mathfrak{H}_9$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge -3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\vee\left[11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_4=0\right]$
$\mathfrak{H}_{10}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge -\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge -3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\vee\left[11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_4=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{H}_{11}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-6\overset{4}{\kappa}_1-6\overset{4}{\kappa}_2-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\frac{3}{2}\overset{4}{\kappa}_1+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[4\overset{4}{\kappa}_1+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\right]\vee\left[\frac{4}{3}\overset{4}{\kappa}_1+\frac{4}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{12}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\left[3\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_1+6\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_7=0\right]\vee\left[11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{13}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{3}{2}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{3}{2}\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1-18\overset{4}{\kappa}_{15}-7\overset{4}{\kappa}_7=0\right]\vee\left[\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{14}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{4}{3}\overset{4}{\kappa}_1-\frac{1}{3}\overset{4}{\kappa}_{15}+\frac{1}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge-\frac{2}{3}\overset{4}{\kappa}_1+\frac{14}{3}\overset{4}{\kappa}_{15}-\frac{14}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1-\frac{8}{3}\overset{4}{\kappa}_{15}+\frac{8}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1-\frac{7}{3}\overset{4}{\kappa}_{15}+\frac{7}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge-\overset{2}{\kappa}_1+\overset{2}{\kappa}_3=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_{15}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[4\overset{4}{\kappa}_1+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\wedge-\frac{2}{3}\overset{4}{\kappa}_1-\frac{14}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\right]\vee\left[\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\right]$
$\mathfrak{H}_{16}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge-\frac{9}{2}\overset{4}{\kappa}_1-\frac{9}{2}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_{15}=0\vee\left[3\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_1+\frac{14}{3}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\right]\vee\left[\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\frac{18}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\right]$
$\mathfrak{H}_{17}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge 3\overset{4}{\kappa}_1+\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\vee\left[8\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_3=0\wedge 2\overset{4}{\kappa}_1+7\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_4=0\right]\vee\left[2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\right]$
$\mathfrak{H}_{18}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge-\frac{1}{4\overset{4}{\kappa}_3}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\frac{4}{3}\overset{4}{\kappa}_1+\frac{4}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{H}_{19}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{1}{2\overset{4}{\kappa}_{15}}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{1}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{H}_{20}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{11}{6}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge-\frac{4}{3}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge-\frac{7}{6}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{2}{3}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{H}_{21}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+3\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{3}{4}\overset{4}{\kappa}_1+\frac{3}{4}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\frac{3}{2}\overset{4}{\kappa}_1+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1-7\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{22}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{3}{2}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{3}{2}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\frac{3}{2}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1-7\overset{4}{\kappa}_7=0\right]$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{H}_{23}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_3=0\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{H}_{24}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{H}_{25}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_{26}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_{27}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-6\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\left[\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge 12\overset{4}{\kappa}_1-5\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{28}$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee\left[\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 12\overset{4}{\kappa}_1-5\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{29}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{1}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\frac{9}{14}\overset{4}{\kappa}_1+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[\frac{9}{7}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_{30}$	$\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{18}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\frac{12}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_{31}$	$6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge-\frac{3}{2}\overset{4}{\kappa}_1+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\left[2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]\vee\left[3\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{H}_{32}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 12\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\left[\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 6\overset{4}{\kappa}_1-\overset{4}{\kappa}_7=0\right]$
$\mathfrak{H}_{33}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{9}{2}\overset{4}{\kappa}_2-\frac{1}{2}\overset{4}{\kappa}_3-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\left[\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_2-\overset{4}{\kappa}_4=0\right]$
$\mathfrak{H}_{34}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0$	$\overset{4}{\kappa}_7=0\vee\left[\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0\right]$
$\mathfrak{H}_{35}$	$\overset{4}{\kappa}_1=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge-\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge 2\overset{2}{\kappa}_1+\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\vee\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_1=0\right]$
$\mathfrak{I}_1$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge-\frac{9}{4}\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{8}\overset{4}{\kappa}_{15}-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{8}\overset{4}{\kappa}_{15}-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$8\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3=0\vee 11\overset{4}{\kappa}_{15}-6\overset{4}{\kappa}_3=0$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{I}_2$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{4}{3}\overset{4}{\kappa}_1-\frac{11}{6}\overset{4}{\kappa}_{15}+\frac{4}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge -\frac{2}{3}\overset{4}{\kappa}_1-\frac{4}{3}\overset{4}{\kappa}_{15}-\frac{2}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1-\frac{7}{6}\overset{4}{\kappa}_{15}+\frac{5}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\frac{2}{3}\overset{4}{\kappa}_{15}+\frac{1}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0$
$\mathfrak{I}_3$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{4}\overset{4}{\kappa}_2-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{9}{4}\overset{4}{\kappa}_2-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$4\overset{4}{\kappa}_1+\overset{4}{\kappa}_2+3\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_2=0\vee 9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0$
$\mathfrak{I}_4$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 13\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge 14\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge -6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1-10\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_2=0\vee 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0\vee 5\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_2=0$
$\mathfrak{I}_5$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{1}{3\overset{4}{\kappa}_{15}}-\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\frac{14}{3}\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge-\frac{8}{3}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge -6\overset{4}{\kappa}_{15}+6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-\frac{7}{3}\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee 3\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0\vee 5\overset{4}{\kappa}_{15}-3\overset{4}{\kappa}_2=0$
$\mathfrak{I}_6$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{1}{7}\overset{4}{\kappa}_1-\frac{10}{7}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge\frac{18}{7}\overset{4}{\kappa}_1-\frac{12}{7}\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+\frac{9}{7}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\frac{18}{7}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{9}{14}\overset{4}{\kappa}_1+\frac{15}{14}\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$9\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+7\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\frac{5}{3}\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0$
$\mathfrak{I}_7$	$\frac{1}{7}\overset{4}{\kappa}_1-\frac{20}{21}\overset{4}{\kappa}_{15}-\frac{10}{21}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge\frac{9}{7}\overset{4}{\kappa}_1-\frac{4}{7}\overset{4}{\kappa}_{15}+\frac{5}{7}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge -2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge\frac{9}{7}\overset{4}{\kappa}_1+\frac{10}{7}\overset{4}{\kappa}_{15}-\frac{2}{7}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\frac{12}{7}\overset{4}{\kappa}_{15}+\frac{6}{7}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_1+\frac{10}{9}\overset{4}{\kappa}_{15}+\frac{5}{9}\overset{4}{\kappa}_{16}=0\vee 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_8$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{4}{3}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\frac{1}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge -\frac{2}{3}\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}-\frac{14}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\frac{8}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+\frac{7}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0$
$\mathfrak{I}_9$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_1-\frac{8}{9}\overset{4}{\kappa}_{15}+\frac{5}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_1+\frac{40}{9}\overset{4}{\kappa}_{15}+\frac{2}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_1-\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{14}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge -6\overset{4}{\kappa}_1-4\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge -2\overset{4}{\kappa}_1-\frac{11}{9}\overset{4}{\kappa}_{15}-\frac{10}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_1+\frac{10}{9}\overset{4}{\kappa}_{15}+\frac{5}{9}\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_{10}$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge\frac{4}{3}\overset{4}{\kappa}_1-\frac{5}{9}\overset{4}{\kappa}_{15}+\frac{13}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge -\frac{2}{3}\overset{4}{\kappa}_1-\frac{2}{9}\overset{4}{\kappa}_{15}-\frac{19}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1+\frac{14}{9}\overset{4}{\kappa}_{15}-\frac{2}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\frac{10}{9}\overset{4}{\kappa}_{15}+\frac{1}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee 2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_{11}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{3}{2}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge -3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge 3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{3}{4}\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee 2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{I}_{12}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge-3\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{3}{4}\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-2\overset{4}{\kappa}_3=0\vee\overset{4}{\kappa}_{15}=0\vee2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0$
$\mathfrak{I}_{13}$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_{14}$	$\overset{4}{\kappa}_1-\frac{2}{3}\overset{4}{\kappa}_{15}-\frac{1}{3}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_{15}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge3\overset{4}{\kappa}_{15}+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{2}\overset{4}{\kappa}_{15}-\frac{5}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{3}{2}\overset{4}{\kappa}_{15}-\frac{1}{4}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0\vee4\overset{4}{\kappa}_1-6\overset{4}{\kappa}_{15}+3\overset{4}{\kappa}_3=0$
$\mathfrak{I}_{16}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{4}{3}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\frac{4}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge-\frac{2}{3}\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}-\frac{2}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\frac{5}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+\frac{1}{3}\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_2=0$
$\mathfrak{I}_{17}$	$\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-\frac{17}{9}\overset{4}{\kappa}_{15}+\frac{1}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge\frac{4}{9}\overset{4}{\kappa}_{15}-\frac{16}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge-\frac{1}{9\overset{4}{\kappa}_{15}}-\frac{19}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{7}{9}\overset{4}{\kappa}_{15}-\frac{1}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_{18}$	$-\overset{4}{\kappa}_{15}-\frac{1}{2}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-\frac{17}{9}\overset{4}{\kappa}_{15}+\frac{1}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_3=0\wedge\frac{4}{9}\overset{4}{\kappa}_{15}-\frac{16}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge-\frac{1}{9\overset{4}{\kappa}_{15}}-\frac{19}{18}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\frac{7}{9}\overset{4}{\kappa}_{15}-\frac{1}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0$
$\mathfrak{I}_{19}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-18\overset{4}{\kappa}_2+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-18\overset{4}{\kappa}_2+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge-\frac{9}{2}\overset{4}{\kappa}_2+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\vee9\overset{4}{\kappa}_2-\overset{4}{\kappa}_3=0$
$\mathfrak{I}_{20}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-2\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge2\overset{4}{\kappa}_{15}-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_{15}=0$
$\mathfrak{I}_{21}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{5}{3}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge-6\overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge-3\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\frac{5}{3}\overset{4}{\kappa}_{15}=0\vee2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_3=0$
$\mathfrak{I}_{22}$	$-\frac{10}{9}\overset{4}{\kappa}_{15}-\frac{5}{9}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_6=0\wedge\frac{8}{3}\overset{4}{\kappa}_{15}+\frac{4}{3}\overset{4}{\kappa}_{16}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_1+\frac{10}{9}\overset{4}{\kappa}_{15}+\frac{5}{9}\overset{4}{\kappa}_{16}=0\vee\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{16}=0$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{I}_{23}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{3}=0\wedge 4\overset{4}{\kappa}_{15}-4\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{4}=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{6}=0\wedge 6\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{7}=0\wedge \overset{4}{\kappa}_{15}+2\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{2}=0\vee\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0$
$\mathfrak{I}_{24}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{2}=0\wedge\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{7}=0\wedge -\frac{1}{2\overset{4}{\kappa}_{3}}-\frac{1}{2}\overset{4}{\kappa}_{4}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$2\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{4}=0\vee\overset{4}{\kappa}_{1}=0$
$\mathfrak{I}_{25}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{7}=0\wedge -\frac{1}{2\overset{4}{\kappa}_{3}}-\frac{1}{2}\overset{4}{\kappa}_{4}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$2\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{4}=0\vee\overset{4}{\kappa}_{1}=0$
$\mathfrak{I}_{26}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge 2\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{4}=0\wedge \overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge\frac{1}{2}\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{7}=0\vee\overset{4}{\kappa}_{3}=0$
$\mathfrak{I}_{27}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{3}=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{4}=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{7}=0\vee\overset{4}{\kappa}_{15}=0$
$\mathfrak{I}_{28}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{3}=0\wedge\overset{4}{\kappa}_{4}=0\wedge\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{7}=0\wedge\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0$	$\left[\overset{4}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0\right]\vee\left[\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0\right]$
$\mathfrak{I}_{29}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\frac{3}{2}\overset{4}{\kappa}_{1}+\frac{3}{2}\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{3}=0\wedge\overset{4}{\kappa}_{4}=0\wedge \frac{3}{2}\overset{4}{\kappa}_{1}+\frac{3}{2}\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\vee\left[\overset{4}{\kappa}_{1}+7\overset{4}{\kappa}_{2}=0\wedge 6\overset{4}{\kappa}_{1}-7\overset{4}{\kappa}_{7}=0\right]$
$\mathfrak{I}_{30}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge -4\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{4}=0\wedge \overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge 2\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{3}=0\vee\left[\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{3}=0\wedge 6\overset{4}{\kappa}_{1}-\overset{4}{\kappa}_{7}=0\right]$
$\mathfrak{I}_{31}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{3}=0\wedge -2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{4}=0\wedge -\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{15}=0\vee\left[\frac{3}{5}\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{15}=0\wedge 12\overset{4}{\kappa}_{1}-5\overset{4}{\kappa}_{7}=0\right]$
$\mathfrak{I}_{32}$	$\overset{4}{\kappa}_{1}=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{2}=0\wedge 2\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{4}=0\wedge \overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{7}=0\wedge\frac{1}{2}\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{9}=0\wedge 2\overset{2}{\kappa}_{1}+\overset{2}{\kappa}_{2}=0\wedge \overset{2}{\kappa}_{3}=0$	$\left[\overset{4}{\kappa}_{15}=0\wedge\overset{2}{\kappa}_{1}=0\right]\vee\left[2\overset{4}{\kappa}_{15}-\overset{4}{\kappa}_{3}=0\wedge\overset{2}{\kappa}_{1}=0\right]$
$\mathfrak{I}_{33}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{2}=0\wedge 3\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge\overset{4}{\kappa}_{7}=0\wedge -\frac{1}{2\overset{4}{\kappa}_{3}}-\frac{1}{2}\overset{4}{\kappa}_{4}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{1}=0\vee\left[\frac{4}{3}\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{3}=0\wedge 2\overset{4}{\kappa}_{1}-3\overset{4}{\kappa}_{4}=0\right]$
$\mathfrak{I}_{34}$	$\frac{2}{3}\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{15}=0\wedge\frac{2}{3}\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge 2\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge -2\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{7}=0\wedge -\frac{3}{2}\overset{4}{\kappa}_{1}-\frac{1}{2}\overset{4}{\kappa}_{3}-\frac{1}{2}\overset{4}{\kappa}_{4}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{1}=0\vee\left[\frac{11}{9}\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{3}=0\wedge\frac{8}{9}\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{4}=0\right]$
$\mathfrak{I}_{35}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0\wedge\overset{4}{\kappa}_{3}+\overset{4}{\kappa}_{6}=0\wedge -6\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{7}=0\wedge -\frac{9}{2}\overset{4}{\kappa}_{1}-\frac{1}{2}\overset{4}{\kappa}_{3}-\frac{1}{2}\overset{4}{\kappa}_{4}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{1}=0\vee\left[\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{3}=0\wedge 4\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{4}=0\right]$
$\mathfrak{I}_{1}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\frac{4}{3}\overset{4}{\kappa}_{1}+\frac{1}{3}\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{3}=0\wedge -\frac{2}{3}\overset{4}{\kappa}_{1}-\frac{14}{3}\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{4}=0\wedge\frac{5}{3}\overset{4}{\kappa}_{1}+\frac{8}{3}\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{6}=0\wedge 6\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{7}=0\wedge\frac{1}{3}\overset{4}{\kappa}_{1}+\frac{7}{3}\overset{4}{\kappa}_{2}+\overset{4}{\kappa}_{9}=0\wedge\overset{2}{\kappa}_{1}=0\wedge\overset{2}{\kappa}_{2}=0\wedge\overset{2}{\kappa}_{3}=0$	$\overset{4}{\kappa}_{2}=0\vee\overset{4}{\kappa}_{1}+7\overset{4}{\kappa}_{2}=0\vee\overset{4}{\kappa}_{1}+\overset{4}{\kappa}_{2}=0$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{F}_2$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge{}^4\kappa_1+{}^4\kappa_2=0\wedge{}^4\kappa_1-\frac{1}{3}{}^4\kappa_{15}+{}^4\kappa_3=0\wedge 4{}^4\kappa_1+\frac{14}{3}{}^4\kappa_{15}+{}^4\kappa_4=0\wedge-{}^4\kappa_1-\frac{8}{3}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge-6{}^4\kappa_1-6{}^4\kappa_{15}+{}^4\kappa_7=0\wedge-2{}^4\kappa_1-\frac{7}{3}{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee{}^4\kappa_1+\frac{5}{3}{}^4\kappa_{15}=0\vee{}^4\kappa_1+\frac{3}{2}{}^4\kappa_{15}=0$
$\mathfrak{F}_3$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge\frac{1}{7}{}^4\kappa_1-\frac{10}{7}{}^4\kappa_{15}+{}^4\kappa_2=0\wedge\frac{9}{7}{}^4\kappa_1+\frac{1}{7}{}^4\kappa_{15}+{}^4\kappa_3=0\wedge-2{}^4\kappa_{15}+{}^4\kappa_4=0\wedge\frac{9}{7}{}^4\kappa_1+\frac{8}{7}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge-\frac{6}{7}{}^4\kappa_1+\frac{18}{7}{}^4\kappa_{15}+{}^4\kappa_7=0\wedge{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee{}^4\kappa_1+\frac{5}{3}{}^4\kappa_{15}=0\vee 2{}^4\kappa_1+{}^4\kappa_{15}=0$
$\mathfrak{F}_4$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge-\frac{3}{2}{}^4\kappa_{15}+{}^4\kappa_2=0\wedge\frac{4}{3}{}^4\kappa_1+\frac{1}{6}{}^4\kappa_{15}+{}^4\kappa_3=0\wedge-\frac{2}{3}{}^4\kappa_1-\frac{7}{3}{}^4\kappa_{15}+{}^4\kappa_4=0\wedge\frac{5}{3}{}^4\kappa_1+\frac{4}{3}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge 3{}^4\kappa_{15}+{}^4\kappa_7=0\wedge\frac{1}{3}{}^4\kappa_1+\frac{7}{6}{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee{}^4\kappa_1+\frac{3}{2}{}^4\kappa_{15}=0\vee 2{}^4\kappa_1+{}^4\kappa_{15}=0$
$\mathfrak{F}_5$	${}^4\kappa_{15}=0\wedge{}^4\kappa_{16}=0\wedge{}^4\kappa_2=0\wedge\frac{1}{2}{}^4\kappa_3+{}^4\kappa_4=0\wedge-\frac{5}{4}{}^4\kappa_3+{}^4\kappa_6=0\wedge{}^4\kappa_7=0\wedge-\frac{1}{{}^4\kappa_3}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_3=0\vee{}^4\kappa_1+\frac{3}{4}{}^4\kappa_3=0$
$\mathfrak{F}_6$	${}^4\kappa_{15}=0\wedge{}^4\kappa_{16}=0\wedge\frac{4}{3}{}^4\kappa_1+\frac{4}{3}{}^4\kappa_2+{}^4\kappa_3=0\wedge-\frac{2}{3}{}^4\kappa_1-\frac{2}{3}{}^4\kappa_2+{}^4\kappa_4=0\wedge\frac{5}{3}{}^4\kappa_1+\frac{5}{3}{}^4\kappa_2+{}^4\kappa_6=0\wedge{}^4\kappa_7=0\wedge\frac{1}{3}{}^4\kappa_1+\frac{1}{3}{}^4\kappa_2+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_1+{}^4\kappa_2=0\vee{}^4\kappa_2=0$
$\mathfrak{F}_7$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge-\frac{3}{2}{}^4\kappa_{15}+{}^4\kappa_2=0\wedge-\frac{1}{2{}^4\kappa_{15}}+{}^4\kappa_3=0\wedge-2{}^4\kappa_{15}+{}^4\kappa_4=0\wedge\frac{1}{2}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge 3{}^4\kappa_{15}+{}^4\kappa_7=0\wedge{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee 2{}^4\kappa_1+{}^4\kappa_{15}=0$
$\mathfrak{F}_8$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge{}^4\kappa_1-{}^4\kappa_{15}+{}^4\kappa_2=0\wedge-\frac{1}{2{}^4\kappa_{15}}+{}^4\kappa_3=0\wedge-2{}^4\kappa_{15}+{}^4\kappa_4=0\wedge\frac{1}{2}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge 3{}^4\kappa_{15}+{}^4\kappa_7=0\wedge{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee 2{}^4\kappa_1+{}^4\kappa_{15}=0$
$\mathfrak{F}_9$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge{}^4\kappa_1+{}^4\kappa_2=0\wedge-\frac{11}{6}{}^4\kappa_{15}+{}^4\kappa_3=0\wedge-\frac{4}{3}{}^4\kappa_{15}+{}^4\kappa_4=0\wedge-\frac{7}{6}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge 3{}^4\kappa_{15}+{}^4\kappa_7=0\wedge\frac{2}{3}{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee{}^4\kappa_1+\frac{3}{2}{}^4\kappa_{15}=0$
$\mathfrak{F}_{10}$	$-{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge-\frac{3}{2}{}^4\kappa_{15}+{}^4\kappa_2=0\wedge-\frac{11}{6}{}^4\kappa_{15}+{}^4\kappa_3=0\wedge-\frac{4}{3}{}^4\kappa_{15}+{}^4\kappa_4=0\wedge-\frac{7}{6}{}^4\kappa_{15}+{}^4\kappa_6=0\wedge 3{}^4\kappa_{15}+{}^4\kappa_7=0\wedge\frac{2}{3}{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee{}^4\kappa_1+\frac{3}{2}{}^4\kappa_{15}=0$
$\mathfrak{F}_{11}$	${}^4\kappa_{15}=0\wedge{}^4\kappa_{16}=0\wedge{}^4\kappa_2=0\wedge 2{}^4\kappa_3+{}^4\kappa_4=0\wedge{}^4\kappa_3+{}^4\kappa_6=0\wedge{}^4\kappa_7=0\wedge\frac{1}{2}{}^4\kappa_3+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_3=0\vee{}^4\kappa_1=0$
$\mathfrak{F}_{12}$	${}^4\kappa_{15}=0\wedge{}^4\kappa_{16}=0\wedge{}^4\kappa_1+{}^4\kappa_2=0\wedge 2{}^4\kappa_3+{}^4\kappa_4=0\wedge{}^4\kappa_3+{}^4\kappa_6=0\wedge{}^4\kappa_7=0\wedge\frac{1}{2}{}^4\kappa_3+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_3=0\vee{}^4\kappa_1=0$
$\mathfrak{F}_{13}$	$2{}^4\kappa_{15}+{}^4\kappa_{16}=0\wedge{}^4\kappa_2=0\wedge-2{}^4\kappa_{15}+{}^4\kappa_3=0\wedge 4{}^4\kappa_{15}+{}^4\kappa_4=0\wedge 2{}^4\kappa_{15}+{}^4\kappa_6=0\wedge{}^4\kappa_7=0\wedge{}^4\kappa_{15}+{}^4\kappa_9=0\wedge{}^2\kappa_1=0\wedge{}^2\kappa_2=0\wedge{}^2\kappa_3=0$	${}^4\kappa_{15}=0\vee{}^4\kappa_1=0$

(Table continued)

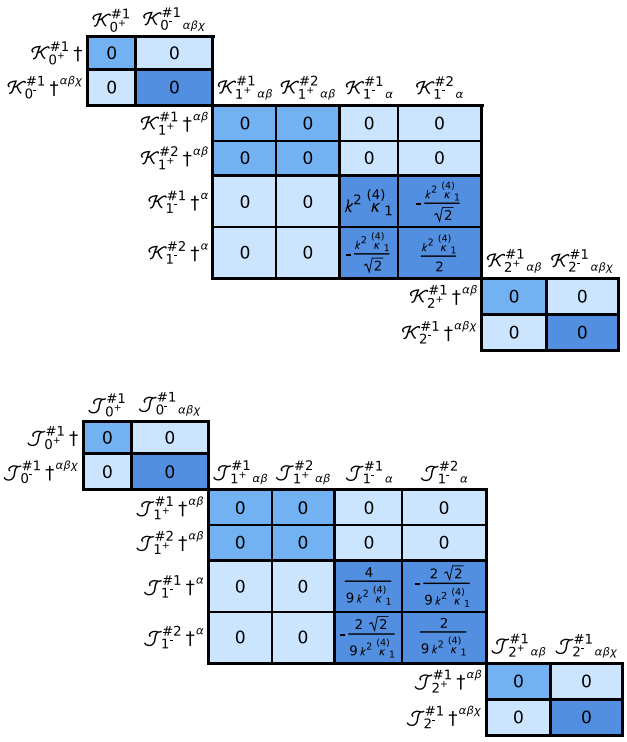
TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{F}_{14}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge 2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1=0$
$\mathfrak{F}_{15}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\frac{1}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{18}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\frac{9}{14}\overset{4}{\kappa}_1+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_1+\frac{7}{9}\overset{4}{\kappa}_3=0$
$\mathfrak{F}_{16}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\frac{1}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{9}{7}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{9}{7}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_{15}=0$
$\mathfrak{F}_{17}$	$\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{18}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\frac{9}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-\frac{12}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_1+\frac{5}{6}\overset{4}{\kappa}_3=0$
$\mathfrak{F}_{18}$	$\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge\frac{18}{5}\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{9}{5}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge-\frac{12}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_1+\frac{5}{3}\overset{4}{\kappa}_{15}=0$
$\mathfrak{F}_{19}$	$2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge 2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge 6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge-\frac{3}{2}\overset{4}{\kappa}_1+\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0$
$\mathfrak{F}_{20}$	$6\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge 3\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-3\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 12\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge 3\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee 2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0$
$\mathfrak{F}_{21}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_4=0\wedge-9\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+7\overset{4}{\kappa}_2=0$
$\mathfrak{F}_{22}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge-\overset{4}{\kappa}_2+\overset{4}{\kappa}_3=0\wedge-4\overset{4}{\kappa}_2+\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_2+\overset{4}{\kappa}_6=0\wedge 6\overset{4}{\kappa}_2+\overset{4}{\kappa}_7=0\wedge 2\overset{4}{\kappa}_2+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_2=0\vee\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0$
$\mathfrak{F}_{23}$	$-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge-\frac{5}{3}\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge 4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0\vee\overset{4}{\kappa}_1+\frac{5}{3}\overset{4}{\kappa}_{15}=0$
$\mathfrak{F}_{24}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\frac{4}{3}\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge-\frac{2}{3}\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_{15}=0$
$\mathfrak{F}_{25}$	$2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_1-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge 4\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge-2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_{15}=0$

(Table continued)

TABLE II. *(Continued)*

Model	Definition	Deconfliction
$\mathfrak{F}_{26}$	$2\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge-\frac{1}{9\overset{4}{\kappa}_1}-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge$ $\frac{32}{9}\overset{4}{\kappa}_1+4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge\frac{19}{9}\overset{4}{\kappa}_1+2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge-2\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge$ $\frac{2}{9}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0\vee\overset{4}{\kappa}_1+\frac{3}{2}\overset{4}{\kappa}_{15}=0$
$\mathfrak{F}_{27}$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_4=0\wedge$ $\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_7=0$
$\mathfrak{F}_{28}$	$\overset{4}{\kappa}_1=0\wedge\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge$ $-\frac{1}{2\overset{4}{\kappa}_3}-\frac{1}{2}\overset{4}{\kappa}_4+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0$
$\mathfrak{K}_1$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_6=$ $0\wedge\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_2$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_4=0\wedge$ $\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_3$	$\overset{4}{\kappa}_1=0\wedge\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge2\overset{4}{\kappa}_3+\overset{4}{\kappa}_4=0\wedge$ $\overset{4}{\kappa}_3+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{2}\overset{4}{\kappa}_3+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=$ $0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_3=0$
$\mathfrak{K}_4$	$\overset{4}{\kappa}_1=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge-2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_3=0\wedge$ $4\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_4=0\wedge2\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_{15}+\overset{4}{\kappa}_9=$ $0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_{15}=0$
$\mathfrak{K}_5$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\frac{4}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0\wedge$ $-\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_4=0\wedge\frac{5}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_6=0\wedge\overset{4}{\kappa}_7=0\wedge\frac{1}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_9=$ $0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_6$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\frac{1}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{9}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0\wedge$ $\overset{4}{\kappa}_4=0\wedge\frac{9}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_6=0\wedge-\frac{6}{7}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_9=0\wedge$ $\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_7$	$\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0\wedge$ $4\overset{4}{\kappa}_1+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_1+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge$ $-2\overset{4}{\kappa}_1+\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_8$	$\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{6}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0\wedge$ $\frac{6}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_4=0\wedge\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_6=0\wedge-\frac{12}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge-\frac{3}{5}\overset{4}{\kappa}_1+\overset{4}{\kappa}_9=$ $0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_9$	$\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge\frac{2}{3}\overset{4}{\kappa}_1+\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\frac{11}{9}\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0\wedge$ $\frac{8}{9}\overset{4}{\kappa}_1+\overset{4}{\kappa}_4=0\wedge\frac{7}{9}\overset{4}{\kappa}_1+\overset{4}{\kappa}_6=0\wedge-2\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge-\frac{4}{9}\overset{4}{\kappa}_1+\overset{4}{\kappa}_9=0\wedge$ $\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\mathfrak{K}_{10}$	$2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{15}=0\wedge2\overset{4}{\kappa}_1+\overset{4}{\kappa}_{16}=0\wedge3\overset{4}{\kappa}_1+\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_1+\overset{4}{\kappa}_3=0\wedge$ $4\overset{4}{\kappa}_1+\overset{4}{\kappa}_4=0\wedge-\overset{4}{\kappa}_1+\overset{4}{\kappa}_6=0\wedge-6\overset{4}{\kappa}_1+\overset{4}{\kappa}_7=0\wedge-2\overset{4}{\kappa}_1+\overset{4}{\kappa}_9=$ $0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	$\overset{4}{\kappa}_1=0$
$\varnothing$	$\overset{4}{\kappa}_1=0\wedge\overset{4}{\kappa}_{15}=0\wedge\overset{4}{\kappa}_{16}=0\wedge\overset{4}{\kappa}_2=0\wedge\overset{4}{\kappa}_3=0\wedge\overset{4}{\kappa}_4=0\wedge\overset{4}{\kappa}_6=$ $0\wedge\overset{4}{\kappa}_7=0\wedge\overset{4}{\kappa}_9=0\wedge\overset{2}{\kappa}_1=0\wedge\overset{2}{\kappa}_2=0\wedge\overset{2}{\kappa}_3=0$	…



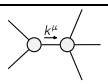
Lagrangian			
$\frac{1}{2}\,{}^{(4)}\kappa_1\,\partial_\beta\mathcal{K}^{\delta}{}_{\chi\delta}\,\partial^\chi\mathcal{K}^{\alpha}{}_{\alpha}{}^{\beta} - \frac{1}{2}\,{}^{(4)}\kappa_1\,\partial_\chi\mathcal{K}^{\delta}{}_{\beta\delta}\,\partial^\chi\mathcal{K}^{\alpha}{}_{\alpha}{}^{\beta}$			
Added source term(s):	$\mathcal{K}^{\alpha\beta\chi}\;\mathcal{J}_{\alpha\beta\chi}$		
Source constraint(s)	# constraint(s)	Covariant form	
$\mathcal{J}_0^{\#1\,\alpha\beta\chi} == 0$	1	$\partial_\delta\partial^\alpha\mathcal{J}^{\beta\chi\delta} + \partial_\delta\partial^\alpha\mathcal{J}^{\delta\beta\chi} + \partial_\delta\partial^\beta\mathcal{J}^{\chi\alpha\delta} + \partial_\delta\partial^\chi\mathcal{J}^{\alpha\beta\delta} + \partial_\delta\partial^\chi\mathcal{J}^{\delta\alpha\beta} + \partial_\delta\partial^\delta\mathcal{J}^{\beta\alpha\chi} ==$ $\partial_\delta\partial^\alpha\mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\beta\mathcal{J}^{\alpha\chi\delta} + \partial_\delta\partial^\beta\mathcal{J}^{\delta\alpha\chi} + \partial_\delta\partial^\chi\mathcal{J}^{\beta\alpha\delta} + \partial_\delta\partial^\delta\mathcal{J}^{\alpha\beta\chi} + \partial_\delta\partial^\delta\mathcal{J}^{\chi\alpha\beta}$	
$\mathcal{J}_{0^+}^{\#1} == 0$	1	$\partial_\beta\mathcal{J}^{\alpha}{}_{\alpha}{}^{\beta} == 0$	
$\mathcal{J}_{1^-}^{\#1\,\alpha} + 2\;\mathcal{J}_{1^-}^{\#2\,\alpha} == 0$	3	$\partial_\chi\partial^\alpha\mathcal{J}^{\beta}{}_{\beta}{}^{\chi} + \partial_\chi\partial^\chi\mathcal{J}^{\beta\alpha}{}_{\beta} == 3\,\partial_\chi\partial_\beta\mathcal{J}^{\beta\alpha\chi}$	
$\mathcal{J}_{1^+}^{\#2\,\alpha\beta} == 0$	3	$\partial_\delta\partial_\chi\partial^\alpha\mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\chi\alpha\beta} == \partial_\delta\partial_\chi\partial^\beta\mathcal{J}^{\chi\alpha\delta}$	
$\mathcal{J}_{1^+}^{\#1\,\alpha\beta} == 0$	3	$\partial_\delta\partial_\chi\partial^\alpha\mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\beta\alpha\chi} == \partial_\delta\partial_\chi\partial^\beta\mathcal{J}^{\chi\alpha\delta} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\alpha\beta\chi}$	
$\mathcal{J}_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5	$3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\alpha\mathcal{J}^{\delta\beta\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\alpha\mathcal{J}^{\delta\beta}{}_{\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\mathcal{J}^{\chi\alpha\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\mathcal{J}^{\chi\alpha\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\mathcal{J}^{\delta\alpha\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\mathcal{J}^{\beta\alpha\delta} +$ $4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\mathcal{J}^{\delta\alpha\beta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{J}^{\alpha\beta\chi} + 3\;\eta^{\beta\chi}\;\partial_\phi\partial^\phi\partial_\epsilon\partial^\alpha\mathcal{J}^{\delta}{}_{\delta}{}^{\epsilon} + 3\;\eta^{\alpha\chi}\;\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\mathcal{J}^{\delta\beta\epsilon} + 3\;\eta^{\beta\chi}\;\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\mathcal{J}^{\delta\alpha}{}_{\delta} ==$ $3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\beta\mathcal{J}^{\delta\alpha\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\beta\mathcal{J}^{\delta\alpha}{}_{\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\mathcal{J}^{\beta\chi\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\mathcal{J}^{\chi\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\mathcal{J}^{\delta\beta\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\mathcal{J}^{\alpha\beta\delta} +$ $2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{J}^{\beta\alpha\chi} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{J}^{\chi\alpha\beta} + 3\;\eta^{\alpha\chi}\;\partial_\phi\partial^\phi\partial_\epsilon\partial^\beta\mathcal{J}^{\delta}{}_{\delta}{}^{\epsilon} + 3\;\eta^{\beta\chi}\;\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\mathcal{J}^{\delta\alpha\epsilon} + 3\;\eta^{\alpha\chi}\;\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\mathcal{J}^{\delta\beta}{}_{\delta}$	
$\mathcal{J}_{2^+}^{\#1\,\alpha\beta} == 0$	5	$3\,\partial_\delta\partial_\chi\partial^\alpha\mathcal{J}^{\chi\beta\delta} + 3\,\partial_\delta\partial_\chi\partial^\beta\mathcal{J}^{\chi\alpha\delta} + 2\;\eta^{\alpha\beta}\;\partial_\epsilon\partial^\epsilon\partial_\delta\mathcal{J}^{\chi}{}_{\chi}{}^{\delta} == 2\,\partial_\delta\partial^\beta\partial^\alpha\mathcal{J}^{\chi}{}_{\chi}{}^{\delta} + 3\,(\partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\alpha\beta\chi} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\beta\alpha\chi})$	
Total # constraint(s):	21		
Resolved pole(s)	# polarization(s)	Square mass	Residue
	2	0	$-\frac{1}{{}^{(4)}\kappa_1}$
Resolved unitarity condition(s):		${}^{(4)}\kappa_1 < 0$	

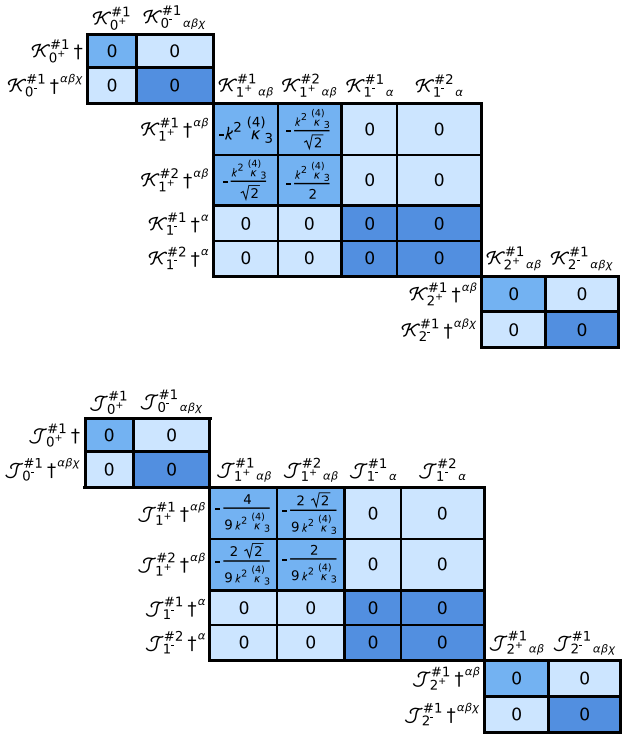
FIG. 6. Output generated by *PSALTer*. The spectrograph of $\mathfrak{K}_2$, as defined in Table II. All notation is defined in Table I and Fig. 3. This is an example of a model with minimal spin-one propagation, i.e., a single vector particle with one free parameter.

to be embedded in some nonlinear completion in which gravity is also present.

The baseline torsion model is the minimal Einstein-Cartan theory (ECT) [39–45]. ECT is the special case of PGT which shares the Einstein-Hilbert action of GR

$$\mathcal{L}_{\rm ECT} \equiv \frac{a_0}{2}\sqrt{-g}\mathcal{F}, \tag{14}$$

where $\mathcal{F} \equiv \mathcal{F}^{\mu\nu}{}_{\mu\nu}$ is the scalar curvature, and Eq. (3) gives the definition of the curvature tensor. Without coupling to matter, Eq. (14) implies the vacuum Einstein-like equations



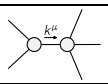
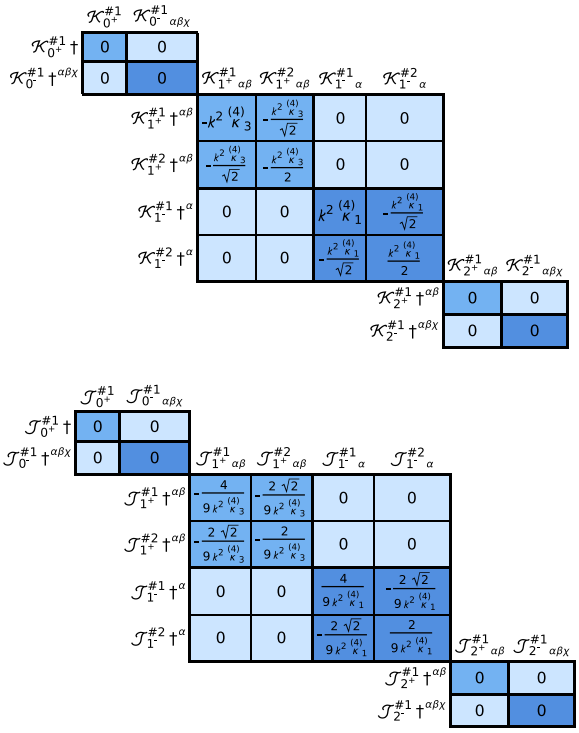
Lagrangian			
$\kappa^{(4)}_3\,\partial_\beta\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}_{\alpha\chi}{}^{\delta} - 2\,\kappa^{(4)}_3\,\partial_\alpha\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}_{\beta\chi}{}^{\delta} - \kappa^{(4)}_3\,\partial_\beta\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}_{\chi\alpha}{}^{\delta} - \frac{1}{2}\,\kappa^{(4)}_3\,\partial_\alpha\mathcal{K}^{\alpha\beta\chi}\,\partial_\delta\mathcal{K}^{\delta}{}_{\beta\chi}$			
Added source term(s):	$\mathcal{K}^{\alpha\beta\chi}\;\mathcal{J}_{\alpha\beta\chi}$		
Source constraint(s)	# constraint(s)	Covariant form	
$\mathcal{J}_{0^-}^{\#1\,\alpha\beta\chi} == 0$	1	$\partial_\delta\partial^\alpha\mathcal{J}^{\beta\chi\delta} + \partial_\delta\partial^\alpha\mathcal{J}^{\delta\beta\chi} + \partial_\delta\partial^\beta\mathcal{J}^{\chi\alpha\delta} + \partial_\delta\partial^\chi\mathcal{J}^{\alpha\beta\delta} + \partial_\delta\partial^\chi\mathcal{J}^{\delta\alpha\beta} + \partial_\delta\partial^\delta\mathcal{J}^{\beta\alpha\chi} == \partial_\delta\partial^\alpha\mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\beta\mathcal{J}^{\alpha\chi\delta} + \partial_\delta\partial^\beta\mathcal{J}^{\delta\alpha\chi} + \partial_\delta\partial^\chi\mathcal{J}^{\beta\alpha\delta} + \partial_\delta\partial^\delta\mathcal{J}^{\alpha\beta\chi} + \partial_\delta\partial^\delta\mathcal{J}^{\chi\alpha\beta}$	
$\mathcal{J}_{0^+}^{\#1} == 0$	1	$\partial_\beta\mathcal{J}^{\alpha}{}_{\alpha}{}^{\beta} == 0$	
$\mathcal{J}_{1^-}^{\#2\,\alpha} == 0$	3	$\partial_\chi\partial_\beta\mathcal{J}^{\beta\alpha\chi} == 0$	
$\mathcal{J}_{1^-}^{\#1\,\alpha} == 0$	3	$\partial_\chi\partial^\alpha\mathcal{J}^{\beta}{}_{\beta}{}^{\chi} + \partial_\chi\partial^\chi\mathcal{J}^{\beta\alpha}{}_{\beta} == \partial_\chi\partial_\beta\mathcal{J}^{\beta\alpha\chi}$	
$\mathcal{J}_{1^+}^{\#1\,\alpha\beta} == \mathcal{J}_{1^+}^{\#2\,\alpha\beta}$	3	$3\,\partial_\delta\partial_\chi\partial^\alpha\mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\beta\alpha\chi} + 2\,\partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\chi\alpha\beta} == 3\,\partial_\delta\partial_\chi\partial^\beta\mathcal{J}^{\chi\alpha\delta} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\alpha\beta\chi}$	
$\mathcal{J}_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5	$3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\alpha\mathcal{J}^{\delta\beta\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\alpha\mathcal{J}^{\delta\beta}{}_{\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\mathcal{J}^{\chi\beta\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\mathcal{J}^{\chi\alpha\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\mathcal{J}^{\delta\alpha\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\mathcal{J}^{\beta\alpha\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\mathcal{J}^{\delta\alpha\beta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{J}^{\alpha\beta\chi} + 3\,\eta^{\beta\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\alpha\mathcal{J}^{\delta}{}_{\delta}{}^{\epsilon} + 3\,\eta^{\alpha\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\mathcal{J}^{\delta\beta\epsilon} + 3\,\eta^{\beta\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\mathcal{J}^{\delta\alpha}{}_{\delta} == 3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\beta\mathcal{J}^{\delta\alpha\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\beta\mathcal{J}^{\delta\alpha}{}_{\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\mathcal{J}^{\beta\chi\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha\mathcal{J}^{\chi\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta\mathcal{J}^{\delta\chi\alpha} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi\mathcal{J}^{\alpha\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{J}^{\beta\alpha\chi} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta\mathcal{J}^{\chi\alpha\beta} + 3\,\eta^{\alpha\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\beta\mathcal{J}^{\delta}{}_{\delta}{}^{\epsilon} + 3\,\eta^{\beta\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta\mathcal{J}^{\delta\alpha\epsilon} + 3\,\eta^{\alpha\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon\mathcal{J}^{\delta\beta}{}_{\delta}$	
$\mathcal{J}_{2^+}^{\#1\,\alpha\beta} == 0$	5	$3\,\partial_\delta\partial_\chi\partial^\alpha\mathcal{J}^{\chi\beta\delta} + 3\,\partial_\delta\partial_\chi\partial^\beta\mathcal{J}^{\chi\alpha\delta} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta\mathcal{J}^{\chi}{}_{\chi}{}^{\delta} == 2\,\partial_\delta\partial^\beta\partial^\alpha\mathcal{J}^{\chi}{}_{\chi}{}^{\delta} + 3\,(\partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\alpha\beta\chi} + \partial_\delta\partial^\delta\partial_\chi\mathcal{J}^{\beta\alpha\chi})$	
Total # constraint(s):	21		
Resolved pole(s)	# polarization(s)	Square mass	Residue
	2	0	$-\frac{1}{\kappa^{(4)}_3}$
Resolved unitarity condition(s):	$\kappa^{(4)}_3 < 0$		

FIG. 7. Output generated by *PSALTer*. The spectrograph of $\mathfrak{K}_3$, as defined in Table II. All notation is defined in Table I and Fig. 3. As with $\mathfrak{K}_2$ in Fig. 7, this is another example of a model with minimal spin-one propagation, but this time the propagating vector is axial (even parity).

$\mathcal{F}_{\lambda\mu}{}^{\lambda}{}_{\nu} = 0$ together with the auxiliary equation $\mathcal{T}_{\mu}{}^{\lambda}{}_{\nu} = 0$. Coupling to fermionic matter results in a contact spin-torsion interaction, whereby the torsion integrates out algebraically to leave effective four-Fermi interactions [31,46–51]. These effects have been put forward as having many phenomenological applications, for example in [47,51–91].

Despite these applications, and despite evidently being within the scope of Eq. (6), it is not immediately clear how nonpropagating torsion can be reconciled conceptually



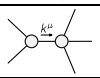
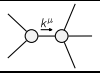
Lagrangian			
$\frac{(4)}{\kappa}_1 \partial_\beta \mathcal{K}^\delta{}_{\chi\delta} \partial^\chi \mathcal{K}^{\alpha\ \beta}{}_\alpha - \frac{(4)}{\kappa}_1 \partial_\chi \mathcal{K}^\delta{}_{\beta\delta} \partial^\chi \mathcal{K}^{\alpha\ \beta}{}_\alpha + \frac{(4)}{\kappa}_3 \partial_\beta \mathcal{K}^{\alpha\beta\chi} \partial_\delta \mathcal{K}_{\alpha\chi}{}^\delta - 2\frac{(4)}{\kappa}_3 \partial_\alpha \mathcal{K}^{\alpha\beta\chi} \partial_\delta \mathcal{K}_{\beta\chi}{}^\delta - \frac{(4)}{\kappa}_3 \partial_\beta \mathcal{K}^{\alpha\beta\chi} \partial_\delta \mathcal{K}_{\chi\alpha}{}^\delta - \frac{1}{2}\frac{(4)}{\kappa}_3 \partial_\alpha \mathcal{K}^{\alpha\beta\chi} \partial_\delta \mathcal{K}^\delta{}_{\beta\chi}$			
Added source term(s):	$\mathcal{K}^{\alpha\beta\chi}\ \mathcal{J}_{\alpha\beta\chi}$		
Source constraint(s)	# constraint(s)	Covariant form	
$\mathcal{J}_{0^-}^{\#1\,\alpha\beta\chi} == 0$	1	$\partial_\delta\partial^\alpha \mathcal{J}^{\beta\chi\delta} + \partial_\delta\partial^\alpha \mathcal{J}^{\delta\beta\chi} + \partial_\delta\partial^\beta \mathcal{J}^{\chi\alpha\delta} + \partial_\delta\partial^\chi \mathcal{J}^{\alpha\beta\delta} + \partial_\delta\partial^\chi \mathcal{J}^{\delta\alpha\beta} + \partial_\delta\partial^\delta \mathcal{J}^{\beta\alpha\chi} == \partial_\delta\partial^\alpha \mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\beta \mathcal{J}^{\alpha\chi\delta} + \partial_\delta\partial^\beta \mathcal{J}^{\delta\alpha\chi} + \partial_\delta\partial^\chi \mathcal{J}^{\beta\alpha\delta} + \partial_\delta\partial^\delta \mathcal{J}^{\alpha\beta\chi} + \partial_\delta\partial^\delta \mathcal{J}^{\chi\alpha\beta}$	
$\mathcal{J}_{0^+}^{\#1} == 0$	1	$\partial_\beta \mathcal{J}^{\alpha\ \beta}{}_\alpha == 0$	
$\mathcal{J}_{1^-}^{\#1\,\alpha} + 2\,\mathcal{J}_{1^-}^{\#2\,\alpha} == 0$	3	$\partial_\chi\partial^\alpha \mathcal{J}^{\beta\ \chi}{}_\beta + \partial_\chi\partial^\chi \mathcal{J}^{\beta\alpha}{}_\beta == 3\,\partial_\chi\partial_\beta \mathcal{J}^{\beta\alpha\chi}$	
$\mathcal{J}_{1^+}^{\#1\,\alpha\beta} == \mathcal{J}_{1^+}^{\#2\,\alpha\beta}$	3	$3\,\partial_\delta\partial_\chi\partial^\alpha \mathcal{J}^{\chi\beta\delta} + \partial_\delta\partial^\delta\partial_\chi \mathcal{J}^{\beta\alpha\chi} + 2\,\partial_\delta\partial^\delta\partial_\chi \mathcal{J}^{\chi\alpha\beta} == 3\,\partial_\delta\partial_\chi\partial^\beta \mathcal{J}^{\chi\alpha\delta} + \partial_\delta\partial^\delta\partial_\chi \mathcal{J}^{\alpha\beta\chi}$	
$\mathcal{J}_{2^-}^{\#1\,\alpha\beta\chi} == 0$	5	$3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\alpha \mathcal{J}^{\delta\beta\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\alpha \mathcal{J}^{\delta\beta}{}_\delta + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta \mathcal{J}^{\alpha\chi\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\beta \mathcal{J}^{\chi\alpha\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta \mathcal{J}^{\alpha\beta\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi \mathcal{J}^{\beta\alpha\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi \mathcal{J}^{\delta\alpha\beta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta \mathcal{J}^{\alpha\beta\chi} + 3\,\eta^{\beta\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\alpha \mathcal{J}^{\delta\ \epsilon}_{\ \delta} + 3\,\eta^{\alpha\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta \mathcal{J}^{\delta\beta\epsilon} + 3\,\eta^{\beta\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon \mathcal{J}^{\delta\alpha}{}_\delta == 3\,\partial_\epsilon\partial_\delta\partial^\chi\partial^\beta \mathcal{J}^{\delta\alpha\epsilon} + 3\,\partial_\epsilon\partial^\epsilon\partial^\chi\partial^\beta \mathcal{J}^{\delta\alpha}{}_\delta + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha \mathcal{J}^{\beta\chi\delta} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha \mathcal{J}^{\chi\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\alpha \mathcal{J}^{\delta\beta\chi} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\chi \mathcal{J}^{\alpha\beta\delta} + 2\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta \mathcal{J}^{\beta\alpha\chi} + 4\,\partial_\epsilon\partial^\epsilon\partial_\delta\partial^\delta \mathcal{J}^{\chi\alpha\beta} + 3\,\eta^{\alpha\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\beta \mathcal{J}^{\delta\ \epsilon}_{\ \delta} + 3\,\eta^{\beta\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial_\delta \mathcal{J}^{\delta\alpha\epsilon} + 3\,\eta^{\alpha\chi}\,\partial_\phi\partial^\phi\partial_\epsilon\partial^\epsilon \mathcal{J}^{\delta\beta}{}_\delta$	
$\mathcal{J}_{2^+}^{\#1\,\alpha\beta} == 0$	5	$3\,\partial_\delta\partial_\chi\partial^\alpha \mathcal{J}^{\chi\beta\delta} + 3\,\partial_\delta\partial_\chi\partial^\beta \mathcal{J}^{\chi\alpha\delta} + 2\,\eta^{\alpha\beta}\,\partial_\epsilon\partial^\epsilon\partial_\delta \mathcal{J}^{\chi\ \delta}_{\ \chi} == 2\,\partial_\delta\partial^\beta\partial^\alpha \mathcal{J}^{\chi\ \delta}_{\ \chi} + 3\,(\partial_\delta\partial^\delta\partial_\chi \mathcal{J}^{\alpha\beta\chi} + \partial_\delta\partial^\delta\partial_\chi \mathcal{J}^{\beta\alpha\chi})$	
Total # constraint(s):	18		
Resolved pole(s)	# polarization(s)	Square mass	Residue
	2	0	$-\frac{1}{\frac{(4)}{\kappa}_3}$
	2	0	$-\frac{1}{\frac{(4)}{\kappa}_1}$
Resolved unitarity condition(s):	$\frac{(4)}{\kappa}_1 < 0\ \&\&\ \frac{(4)}{\kappa}_3 < 0$		

FIG. 8. Output generated by *PSALTer*. The spectrograph of $\mathfrak{J}_{12}$, as defined in Table II. All notation is defined in Table I and Fig. 3. This is an example of a model with minimal double spin-one propagation, i.e., a pair of vector particles with two free parameters, one for each sector (polar and axial).

with the EFT framework in Eq. (1).[4] Among a large literature, one particular body of work stands out for its recent attempts at making this reconciliation. This avenue of work was opened up with the observation that the cutoff scale of Higgs inflation becomes elevated when the connection is taken to be independent of the metric; in essence, an equivalent way of positing Eq. (5a) known historically as the *Palatini* formulation [64,92,93]. The basic Palatini Higgs model extends Eq. (14) by a nonminimal coupling between the bilinear of the Higgs doublet and $\mathcal{F}$. It was proposed in [50] to extend this model by including all other operators with the lowest mass dimension which do not endow $\mathcal{T}_\mu{}^\lambda{}_\nu$ with a propagator pole.[5] This approach is evidently close in spirit to the present letter, but since we exclude from our final tally of unitary models those with completely nonpropagating torsion (trivial, empty spectra according to *PSALTer*), we do not connect with it.

C. Propagating torsion

By contrast with Eq. (14), propagating torsion is usually motivated by the action

$$\begin{aligned}\mathcal{L}_{\rm PGT} \equiv -\frac{1}{2}\sqrt{-g}\Big[&-a_0\mathcal{F} + \mathcal{F}^{\mu\nu\rho\sigma}(g_1\mathcal{F}_{\mu\nu\rho\sigma} \\ &+ g_3\mathcal{F}_{\rho\sigma\mu\nu} + g_4\mathcal{F}_{\mu\rho\nu\sigma}) + \mathcal{F}^{(13)\mu\nu}(g_7\mathcal{F}^{(13)}{}_{\mu\nu} \\ &+ g_8\mathcal{F}^{(13)}{}_{\nu\mu}) + g_{16}\mathcal{F}^{(13)2} + \mathcal{T}^{\mu\rho\nu}(b_1\mathcal{T}_{\mu\rho\nu} \\ &+ b_2\mathcal{T}_{\mu\nu\rho}) + b_3\mathcal{T}^\mu\mathcal{T}_\mu\Big],\end{aligned} \tag{15}$$

where two new contractions are defined as $\mathcal{F}^{(13)}{}_{\mu\nu} \equiv \mathcal{F}_{\lambda\mu}{}^\lambda{}_\nu$ and $\mathcal{T}_\mu \equiv \mathcal{T}_\lambda{}^\lambda{}_\mu$.[6]

The logic underpinning the nonlinear completion in Eq. (15) is that one should restrict to a Yang-Mills-type action which is up to quadratic order in the field-strength tensors concomitant with gauging the Poincaré group [94–98]. Returning to the discussion in Sec. I, this is precisely the nonlinear completion which is assumed in [33,34]. Among the a_0, $\{b_i\}$ and $\{g_i\}$ are only ten couplings, short of the 12 couplings in Eq. (6).

A large literature is devoted to nonsymmetry-motivated tunings of these couplings so as to produce ghost-tachyon-free linear spectra [33,34,96–142]. It was argued in Sec. I and [1,2] that this process is problematic, but the nonlinear completion in Eq. (15) anyway leads to separate nonlinear problems even when the linear spectra are ghost- and tachyon-free. These nonlinear problems manifest as strongly coupled particles [88,94,97,138,143–166], whose presence suggests that the afflicted theory is inherently nonperturbative near the Minkowski background upon which it was first tuned [154–156,160,167–171]. Any gauge symmetries which do emerge through the arbitrary tuning process are also typically broken at nonlinear order (so-called "accidental" symmetries) [96,97,165,172–181].[7]

Since the seminal work of Yo and Nester a quarter of a century prior [96,97], the consensus on these linear and nonlinear problems (see, e.g., [96,97,175,176]) has been that[8]:

> The only consistent Einstein–Cartan theories or Poincaré gauge theories are those in which the spin-zero scalar or pseudoscalar torsion is allowed to propagate.

The spin-zero parts of torsion correspond to the scalar 0^+ and pseudoscalar 0^- modes in Table I, which together span the first diagonal blocks of the wave operator and propagator in Fig. 3. Indeed, by examining Fig. 3, we see that in the general IR foundation these modes both try to propagate, respectively with masses

$$m_{0^+}^2 \equiv \frac{\Lambda^2\left(2\overset{(2)}{\kappa}_1 + \overset{(2)}{\kappa}_2 - 3\overset{(2)}{\kappa}_3\right)}{3\overset{(4)}{\kappa}_1 - 2\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16} + 3\overset{(4)}{\kappa}_2 + \overset{(4)}{\kappa}_3 + \overset{(4)}{\kappa}_6}, \tag{16a}$$

$$m_{0^-}^2 \equiv \frac{\Lambda^2\left(\overset{(2)}{\kappa}_2 - \overset{(2)}{\kappa}_1\right)}{\overset{(4)}{\kappa}_{15} - \overset{(4)}{\kappa}_{16}}. \tag{16b}$$

Notwithstanding these poles, the underlying theory of Eq. (6) is as a whole nonunitary.

The paradigm of (pseudo)scalar-only torsion was challenged at the classical level with two recent proposals for *vector* torsion originating in the 1^+ and 1^- sectors of Table I. Interestingly, these vector modes, which populate the second diagonal blocks in Fig. 3, clearly account for the richest sector of the IR limit of torsion in Eq. (6): both parities are able to simultaneously propagate pairs of particles with distinct masses given by the solutions to a quadratic equation in k^2. The recent proposals for sourcing particles from this sector were as follows:

More fields: In [88] it was shown using a fully nonperturbative Hamiltonian analysis that strongly

[4]Given the large literature claiming to extract predictive results from nonpropagating torsion, the fact that any such model is unlikely to deviate from the preexisting EFT of metric-based gravity coupled to matter, once the torsion has been integrated out, seems concerning. This question will be investigated in further work.

[5]This process was extended beyond torsion to fully nonmetric metric-affine geometries in [51,79].

[6]In Eqs. (14) and (15) we use the conventions of [35]. In particular a_0 and the $\{b_i\}$ are of mass dimension two, while the $\{g_i\}$ are dimensionless.

[7]See also [62,95,97,101,102,104,114,122,133,182–184].

[8]See also [105,106,109,111–113,118,123,125,127,132,136,185–188] for various applications, [98,110,115,117,130] to review the literature, and [35,124,131,134,135,189–193] for analyses of spacetime nonmetricity which are more or less analogous.

coupled torsion modes could be pacified by extra multiplier fields, leading to an Einstein-Proca theory from vector torsion.

Bigger gauge group: In [194] it was shown that the Maxwell-like operator for $\mathcal{T}_\mu$—which is missing from Eq. (15) but reached by setting $\overset{(4)}{\kappa}_1 + \overset{(4)}{\kappa}_2 = 0$ in Eq. (6)—could be motivated as a Yang–Mills-type term when the Poincaré gauge group is enlarged to the full conformal group.

Both of these proposals implicitly assume that the restriction to the Yang-Mills-type action in Eq. (15) is physically well motivated. Indeed, this idea has itself been challenged by the authors of [35] and in recent efforts [90,137,195,196] in which gravitational model-building is attempted to be reconciled with basic expectations of quantum field theory. The objective of the present series is to fall in line with this predictive (albeit arduous) framework, and it will now be shown that this provides the strongest motivation for propagating *vector* torsion to date.

D. Science products

The systematic identification of unitary and symmetric models within the pair-antisymmetric tensor field $\mathcal{K}_{\alpha\beta\gamma}$ yields multiple independent configurations exhibiting significantly greater complexity compared to the previously studied and well-known case of the totally symmetric tensor. However, such complexity is not reflected in the type of propagation, which invariably involves vector particles (of either parity). It is a critical outcome of this study that within the sub-set of 22 models for which the unitarity is assessed[9]:

> We do not find any symmetry which can support the tuning necessary for propagating spin-zero or spin-two torsion.

Indeed, no known examples of symmetric propagation exhibiting these features exist in the literature. Instead, the complex nature of the 22 identified unitary models is reflected in various distinctive and novel frameworks supporting vector propagation.

Starting from the simplest scenario, spin-one propagation with only one free parameter, the models extend to more sophisticated configurations with multiple parameters (and thus independent combinations of operators), resulting, in some cases, in the simultaneous propagation of a pair of spin-one modes.

The ultimate measure of a model's computational usefulness depends on its ability to support consistent interactions and to yield nontrivial theories. This likely requires dedicated studies for each of the distinct IR foundations identified. Here, we provide an initial broad classification of the 22 models, categorized by their propagation characteristics and overall complexity, the latter simply assessed by counting the number of free coefficients involved.

E. Minimal spin one

We find four models that minimally propagate a vector particle. The spectrograph in Fig. 6 reveals that $\mathfrak{K}_2$ is the simplest implementation of 1^- propagation. The same propagation is afforded by model $\mathfrak{J}_{14}$, which adds a decoupled and nonpropagating scalar sector, allowed by a less constraining gauge invariance. An axial vector is instead propagated by model $\mathfrak{K}_3$—see Fig. 7—and, with a less constraining symmetry, by $\mathfrak{J}_{11}$.

F. Nonminimal spin one

In the presence of multiple parameters, a thorough study might help in revealing possible reductions by highlighting the irrelevance and decoupling of particular combinations. Here we resort to a simpler measure, based on how many of the surviving Lagrangian parameters appear in the unitarity conditions. This simplified approach selects $\mathfrak{G}_{21}$ as a particularly involved model which, nevertheless, is symmetric, unitary, and propagates only one (vector) sector. While further study might reveal some simplification, the unitarity constraints involve all five parameters of the corresponding Lagrangian.

Slightly less intricate is model $\mathfrak{H}_{28}$, with four parameters. This category is further populated by the remaining set $\mathfrak{J}_{25}$, $\mathfrak{H}_7$, $\mathfrak{J}_{33}$, $\mathfrak{J}_{30}$, $\mathfrak{J}_{31}$, $\mathfrak{J}_{35}$, $\mathfrak{J}_6$, $\mathfrak{H}_{33}$, $\mathfrak{J}_{26}$, $\mathfrak{J}_{17}$, $\mathfrak{H}_{32}$, $\mathfrak{J}_{16}$ and $\mathfrak{J}_{21}$. All these models involve up to three parameters and nontrivial unitarity conditions.

G. Minimal double spin one

Multiple simultaneous propagation of species is one of the more interesting results from the use of high-rank fields. While often competing, with conflicting requirements of unitarity, it is known that different sectors can propagate in mutual harmony already for the totally symmetric case [2,197].

In the larger space of a pair-antisymmetric field, we find three apparently different models which simultaneously propagate two vectors. As illustrated in Fig. 8, the model $\mathfrak{J}_{12}$ is particularly simple, with just two parameters, one for each sector (polar and axial), without any intertwining of unitarity conditions.

H. Nonminimal double spin one

In more complex cases, the models $\mathfrak{H}_8$ and $\mathfrak{H}_{27}$ have up to four parameters, all of which are involved in the unitarity conditions. Part of the apparent growth in complexity for the last two models can be blamed on the reduced

[9]Hopes of recovering simple, unitary single-particle propagation from the complex models where unitarity could not be assessed are naturally low, given the observed presence of multiple poles across many different sectors.

symmetry in the spin-two sector which, unlike for $\mathfrak{F}_{12}$, is not completely degenerate.

I. Further work

While Fig. 5 and Table II should exhaustively catalog the IR foundations associated with the field defined in Eq. (2), the increased complexity of the system leads to limitations in our subsequent analysis compared to that performed in [2], namely:

Unitarity: It is possible that our final tally of 22 unitary models out of 206 candidate IR foundations in Fig. 5 and Table II may be slightly increased in the future. This is because a small minority of models in the catalog resisted automatic unitarity analysis by *PSALTer*.[10] Note that the number of new models, if any, is expected to be small: most of the viable IR foundations for parity-preserving torsion have been established in this work.

Parametric models: We do not provide details of symmetric models which may be reached by the imposition of inherently nonlinear constraints on the couplings; a concept introduced in Sec. II. Whether parametric models offer a robust IR foundation for constructing EFTs is a matter to be investigated separately, ideally by performing the renormalization of a toy model.

Beyond these aspects of further work, the same extensions apply as were mentioned in [2], namely the inclusion of parity-violating operators and the systematic nonlinear completion of each model in the catalog. The former task is straightforward, and has been facilitated by [37]. The latter task is highly nontrivial, and may well prove to be impossible for most of the catalog.

As a final comment, we reiterate that the critical need for reconciling torsionful model-building with the principles of quantum field theory has been highlighted in at least three branches of the literature, preliminarily in [33,34], and more thoroughly in [90,137,195,196], and separately in [50,51,64,79,92,93] and related works (see most recently [198] and a review in [186]). It is to be hoped for a future integration between approaches, whose conclusions do not always align. Outside of this literature, it is helpful to remember that—when engaging in responsible gravitational model-building—quantum considerations are in no sense "optional."

[10]Somewhat confusingly, we count 22 such treatment-resistant models: precisely the same number as are confirmed to be unitary. To clarify why the analysis fails in these cases: the final step in the *PSALTer* algorithm is to reduce the gathered-together system of inequality constraints for positive pole residues and real masses. This final step relies on certain proprietary functionality in *Wolfram*, here running on a single AMD Ryzen 7 6800U CPU core, and is set to timeout after an arbitrary period of 20 seconds. It is not suggested that these models are in any way exceptional physically.

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DATA AVAILABILITY

The code and data that support the findings of this article are openly available [201].

APPENDIX: CATALOG

This appendix presents, in Table II, the complete definitions for all models illustrated in the hierarchy of Fig. 5.

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