

Bounds on Screened Dark Energy from Near-Earth Space-Based Measurements

Fabiano Feleppa^{1,2,*}, Welmoed Marit de Graaf^{1,†}, Philippe Brax^{3,‡}, and Gaetano Lambiase^{1,2,§}

¹*Dipartimento di Fisica “E.R. Caianiello”, Università di Salerno, Via Giovanni Paolo II 132, I-84084 Fisciano, Italy*

²*INFN, Sezione di Napoli, Gruppo Collegato di Salerno, Italy*

³*Institut de Physique Théorique, Université Paris-Saclay, CEA, CNRS, F-91191 Gif-sur-Yvette Cedex, France*



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We test screened dark energy with near-Earth, space-based measurements. In a post-Newtonian framework, we compute leading corrections to geodetic precession (Gravity Probe B), LAGEOS-2 pericenter advance, and the Sagnac delay in a prospective orbital configuration, yielding bounds on chameleon, symmetron, and dilaton models. LAGEOS-2 sets the strongest Earth-orbit limits on symmetron and dilaton, while a Sagnac setup at the projected sensitivity of state-of-the-art space clocks gives the tightest chameleon constraint. These results show that low-density, space-based experiments sensitively probe screened dark energy and exclude previously allowed parameter space. Notably, at nuclear-clock precision $\mathcal{O}(10^{-19})$, a Sagnac test would exclude the entire chameleon parameter space considered.

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Introduction—Understanding the physical origin of the late-time acceleration of the Universe remains a central challenge in fundamental physics. The prevailing explanation—identifying the dark energy component of the Universe with a cosmological constant—is empirically successful across multiple, independent probes (see, e.g., Refs. [1–5]), yet it sharpens the naturalness problem associated with vacuum energy [6–9] and must contend with specific “tensions” within the standard Lambda Cold Dark Matter (Λ CDM) model [10–33]. A well-motivated possibility is that the dark sector contains new light degrees of freedom and/or that gravity departs from general relativity [34–53]; see also Ref. [54] for a different perspective. However, if the new ingredient behind cosmic acceleration is a very light field that interacts with ordinary matter, it would generically produce an extra long-range “fifth force,” a signal that precision tests in the laboratory and in the Solar System have not detected. To remain consistent with those tests, the new interaction must be effectively hidden locally while still influencing cosmic dynamics on large scales. This is the idea of screening: in dense environments the extra force is suppressed, whereas on cosmological scales it can remain active (for details, see

the recent review [55]). Very well-studied examples include the chameleon mechanism [56–109] (the field becomes short-ranged as the surrounding density rises), the symmetron [110–135] and dilaton [136–153] mechanisms (the coupling to matter switches off in high-density regions), and the K-mouflage mechanism [154,155] and the Vainshtein effect [156] (nonlinear derivative self-interactions amplify the effective kinetic term and suppress scalar gradients around massive bodies, screening the force within a characteristic K-mouflage-Vainshtein radius). These frameworks have been developed extensively and tested against a broad range of measurements—from torsion-balance and atom-interferometry experiments to lunar and satellite laser ranging and other astrophysical and cosmological observations—yielding tight constraints while still leaving viable regions of parameter space to explore [157].

Screened modified gravity can be cast in the language of scalar-tensor theories [158,159]. In the case of weak gravitational fields, one can consider the Parameterized Post-Newtonian (PPN) expansion, characterized by an effective gravitational strength $\mathcal{G}$ and the PPN coefficients γ and β . Screening shows up as an environment-source dependence of these quantities [159]—high-density regions drive $\mathcal{G} \rightarrow G$, $\gamma \rightarrow 1$, and $\beta \rightarrow 1$, keeping the extra force hidden, while lower density can allow for small departures. Unlike purely laboratory tests, space-based measurements are crucial because the ambient density in near-Earth is many orders of magnitude lower, which can reduce screening and enhance sensitivity to deviations.

In the context of high-precision space-based tests of general relativity, landmark experiments include Gravity Probe B [160,161], Lunar Laser Ranging [162,163], LARES-2 [164,165], LAGEOS-2 [166–168], very-long-baseline interferometry [169,170], the GINGER ring-laser

*Contact author: ffeleppa@unisa.it

†Contact author: w.degraaf@studenti.unisa.it

‡Contact author: philippe.brax@ipht.fr

§Contact author: lambiase@sa.infn.it

program [171,172], and the GRACE and GRACE-FO gravity missions [173,174], among others. These experiments tighten bounds on the PPN coefficients γ and β and on associated non-Keplerian effects, thereby constraining broad classes of fifth-force and modified-gravity scenarios (see, e.g., Refs. [175–178]), including screened models; with current timing capabilities, Sagnac-type orbital configurations using space-qualified clocks also emerge as sensitive probes of tiny departures from general relativity in Earth’s field, complementing the tests above [179]. In the following, we investigate screened dark energy using a selection of the space-based tests outlined above; within the formalism of Ref. [159] at first post-Newtonian order (1PN) (see also Ref. [180]), we obtain the leading corrections induced by chameleon, symmetron, and dilaton to three key observables: (i) the geodetic precession of a gyroscope as measured by Gravity Probe B, (ii) the pericenter precession inferred from LAGEOS-2, and (iii) the Sagnac time delay in a prospective setup employing state-of-the-art space clocks; we then map these predictions onto the screening parameter space and compare them with Solar System and laboratory bounds. This yields new constraints, thereby excluding previously allowed regions of parameter space. In what follows, we work in units with $c = \hbar = 1$ and with signature convention $\{-, +, +, +\}$.

Screened scalar-tensor theories—At 1PN order, the Jordan-frame line element for a static, spherically symmetric source of mass M can be written as [181]

$$ds^2 = -\left(1 - \frac{2\mathcal{G}M}{r} - \beta \frac{2\mathcal{G}^2 M^2}{r^2}\right) dt^2 + \left(1 - \gamma \frac{2\mathcal{G}M}{r}\right) (dr^2 + r^2 d\Omega^2), \quad (1)$$

where $d\Omega^2 \equiv d\vartheta^2 + \sin^2\vartheta d\varphi^2$ is the metric on the unit two-sphere, $\mathcal{G}$ is the effective gravitational strength, and γ and β are the PPN parameters. In screened models, these quantities depend on the ambient background density ρ_∞ (here taken as the local Galactic density) through ϕ_∞ , the scalar field value far from the source. In what follows, we consider three representative screening mechanisms: chameleon, symmetron, and dilaton. For the chameleon mechanism, the effective gravitational strength $\mathcal{G}$, γ , and β are given by [159,180]

$$\mathcal{G}_{\text{cham}} = G \left(1 + \frac{\beta_m \phi_\infty}{M_{\text{Pl}} \Phi_N}\right), \quad (2)$$

$$\gamma_{\text{cham}} = 1 - \frac{2\beta_m \phi_\infty}{M_{\text{Pl}} \Phi_N}, \quad (3)$$

$$\beta_{\text{cham}} = 1 - \frac{3}{4\Phi_N(n+1)} \left(\frac{\phi_\infty}{M_{\text{Pl}}}\right)^2, \quad (4)$$

respectively, where $\Phi_N = GM/R$ is the Newtonian potential, with R being the gravitating source’s radius, and

$$\phi_\infty = \left(\frac{nM_{\text{Pl}}\Lambda^{4+n}}{\beta_m \rho_\infty}\right)^{\frac{1}{n+1}}, \quad (5)$$

where Λ sets the mass scale, $\beta_m > 0$ is the dimensionless matter coupling strength of the scalar, and $n > 0$.

For the symmetron, $\mathcal{G}$, γ , β , and ϕ_∞ are [159,180]

$$\mathcal{G}_{\text{sym}} = G \left(1 + \frac{\phi_\infty^2}{M_{\text{sym}}^2 \Phi_N}\right), \quad (6)$$

$$\gamma_{\text{sym}} = 1 - \frac{2\phi_\infty^2}{M_{\text{sym}}^2 \Phi_N}, \quad (7)$$

$$\beta_{\text{sym}} = 1 + \frac{1}{2} \left(\frac{\phi_\infty}{M_{\text{sym}} \Phi_N}\right)^2, \quad (8)$$

$$\phi_\infty = \frac{\mu}{\sqrt{\lambda}} \sqrt{1 - \frac{\rho_\infty}{M_{\text{sym}}^2 \mu^2}}, \quad (9)$$

respectively, where μ and M_{sym} are mass-dimension one parameters and λ is a positive, dimensionless coupling constant. The above results hold in the regime $\rho_\infty < M_{\text{sym}}^2 \mu^2$.

Finally, the dilaton case is characterized by [159,180]

$$\mathcal{G}_{\text{dil}} = G \left(1 + \frac{A_2 \phi_\infty^2}{M_{\text{Pl}}^2 \Phi_N}\right), \quad (10)$$

$$\gamma_{\text{dil}} = 1 - \frac{2A_2 \phi_\infty^2}{M_{\text{Pl}}^2 \Phi_N}, \quad (11)$$

$$\beta_{\text{dil}} = 1 + \frac{1}{2} \left(\frac{A_2 \phi_\infty}{M_{\text{Pl}} \Phi_N}\right)^2, \quad (12)$$

$$\phi_\infty = \frac{\lambda_{\text{dil}} M_{\text{Pl}} V_0}{A_2 \rho_\infty}, \quad (13)$$

where V_0 is a constant with units of energy density, λ_{dil} is the self-coupling, and A_2 is the parameter controlling the strength of the coupling of the scalar to matter [182].

It is worth noting the extreme similarity between the PPN parameters of the symmetron and dilaton where $M_{\text{sym}} \equiv M_{\text{Pl}}/A_2$. The difference between the two models arises from their dependence on ρ_∞ via ϕ_∞ , and the resulting difference can be significant.

Further details on the framework, as well as of the approximations made to derive the equations discussed here, are provided in Supplemental Material (SM) [183].

Solar System tests—Here we present formulas for the three observables used to constrain screened modified gravity: the geodetic precession of a gyroscope (as measured by Gravity Probe B [160,161]), the secular pericenter-precession rate of LAGEOS-2 [166–168], and the Sagnac time delay for an idealized experiment around a spherically symmetric central mass (the Earth, in our case) [179]. We also present our constraint methodology.

For detailed descriptions of these three experiments and the derivations, see SM [183].

Geodetic precession: Starting from the metric (1), the geodetic precession per orbit at 1PN is found to be

$$\alpha_{\text{screen}} = \pi(1 + 2\gamma) \frac{\mathcal{G}M}{R_{\text{orb}}}, \quad (14)$$

where we recall that the effective gravitational strength $\mathcal{G} \rightarrow (\mathcal{G}_{\text{cham}}, \mathcal{G}_{\text{sym}}, \mathcal{G}_{\text{dil}})$ and $\gamma \rightarrow (\gamma_{\text{cham}}, \gamma_{\text{sym}}, \gamma_{\text{dil}})$, depending on the mechanism under consideration; by multiplying α by the number of orbits per year, we obtain the drift rate measured by Gravity Probe B (GP-B), which has an associated relative uncertainty of approximately 0.28% [198]. Any correction to the rate due to the presence of a screened scalar field must remain within this limit to ensure consistency; hence we require

$$\left| \frac{\alpha_{\text{screen}} - \alpha_{\text{GR}}}{\alpha_{\text{GR}}} \right| \lesssim 2.8 \times 10^{-3}, \quad (15)$$

where $\alpha_{\text{GR}} \equiv \alpha_{\text{screen}}|_{\mathcal{G} \rightarrow G, \gamma \rightarrow 1}$.

We note that Earth's oblateness affects GP-B both through gravity-gradient torques (modeled [198]) and through a relativistic quadrupole correction to the geodetic drift; the latter is $\sim 10^{-3}$ of the monopole term [199]. Since Earth's J_2 is known at the $\sim 10^{-7}$ level [200], the induced fractional uncertainty turns out to be $\sim 10^{-10}$, negligible compared to the GP-B uncertainty used.

Pericenter advance: At 1PN order, the secular pericenter-precession rate for a test body orbiting a spherically symmetric central mass in scalar-tensor gravity is [181]

$$\Delta \dot{\omega}^{\text{screen}} = \frac{3(\mathcal{G}M)^{3/2}}{a^{5/2}(1 - e^2)} \frac{2 + 2\gamma - \beta}{3}, \quad (16)$$

where a denotes the semimajor axis of the ellipse and e is the eccentricity of the orbit. Furthermore, we recall that screening effects are encoded in the gravitational strength $\mathcal{G}$, γ , and β : $\mathcal{G} \rightarrow (\mathcal{G}_{\text{cham}}, \mathcal{G}_{\text{sym}}, \mathcal{G}_{\text{dil}})$, $\gamma \rightarrow (\gamma_{\text{cham}}, \gamma_{\text{sym}}, \gamma_{\text{dil}})$, and $\beta \rightarrow (\beta_{\text{cham}}, \beta_{\text{sym}}, \beta_{\text{dil}})$, depending on the specific mechanism considered. We constrain the screening parameter space by requiring that the secular pericenter-precession rate predicted by the screened model does not differ from the general relativity prediction by more than the relative uncertainty of the LAGEOS-2 measurement [201]:

$$\left| \frac{\Delta \dot{\omega}^{\text{screen}} - \Delta \dot{\omega}^{\text{GR}}}{\Delta \dot{\omega}^{\text{GR}}} \right| \lesssim 2.1 \times 10^{-3}, \quad (17)$$

where $\Delta \dot{\omega}_{\text{GR}} \equiv \Delta \dot{\omega}^{\text{screen}}|_{\mathcal{G} \rightarrow G, \gamma \rightarrow 1, \beta \rightarrow 1}$.

It is important to point out that, in orbit determinations, the product GM is solved directly from the same tracking data: any orbit-constant change in the gravitational strength due to screening is simply absorbed into that fitted parameter and cancels in the ratio of secular rates.

Consequently, the LAGEOS-2 observable is insensitive to $\mathcal{G}$ itself and constrains only the PPN factor $(2 + 2\gamma - \beta)/3$. This modeling proviso should be kept in mind when deriving the constraints.

Moreover, we also point out that, in the LAGEOS-2 analysis, the Earth's quadrupole J_2 is explicitly modeled and subtracted [201].

Sagnac time delay: The Sagnac experiment proposed in Ref. [179] is conceived as a space-based analog of a ring laser gyroscope, but with the closed path given by a satellite's orbit around a central body (the Earth, in our case). A satellite in circular orbit is imagined to carry a precision atomic or nuclear clock, which acts as the reference against which light travel times can be measured. Two light beams are sent simultaneously in opposite directions along the orbital loop: one corotating with the orbital motion, the other counterrotating. After completing a full revolution, the beams return to the satellite, where the onboard clock records their arrival times. Starting from the 1PN metric in Eq. (1), the Sagnac time difference between the two signals, expressed in the satellite's proper time τ , is

$$\Delta \tau_{\text{screen}} = 4\pi R_{\text{orb}}^2 \Omega \left[1 + (1 + 2\gamma) \frac{\mathcal{G}M}{R_{\text{orb}}} \right], \quad (18)$$

where Ω is the satellite's constant angular velocity and R_{orb} is its orbital radius. The above formula is valid in the slow-rotation regime, $R_{\text{orb}}\Omega \ll 1$.

Proceeding as in the two previous cases, the screening parameter space can be constrained by requiring the relative deviation from the general relativity prediction in the Sagnac time shift to be less than the experimental relative uncertainty. As previously mentioned, since no orbital Sagnac experiment of the type proposed has yet been performed, there are no direct data available to determine its achievable precision. In order to set indicative bounds, one can instead rely on the performance of present-day space-qualified atomic clocks, which provide the natural reference for measuring timing differences in such a setup. Current devices such as the Deep Space Atomic Clock [202] and the PHARAO clock aboard the ACES mission [203] reach fractional frequency uncertainties in the range of $10^{-15} - 10^{-16}$ over relevant integration times (below, we choose 10^{-15} for a conservative estimate). Because fractional frequency stability directly sets the smallest resolvable relative timing deviation, we adopt this level of sensitivity as the relative uncertainty for our prospective measurement. Therefore, we can write

$$\left| \frac{\Delta \tau_{\text{screen}} - \Delta \tau_{\text{GR}}}{\Delta \tau_{\text{GR}}} \right| \lesssim 10^{-15}, \quad (19)$$

where $\Delta \tau_{\text{GR}} \equiv \Delta \tau_{\text{screen}}|_{\mathcal{G} \rightarrow G, \gamma \rightarrow 1}$.

Above, we did not include the effect of the quadrupole moment J_2 . In SM we estimate the J_2 error budget for the

Sagnac case; since the fractional impact of the J_2 uncertainty on the Sagnac time delay (normalized to the general relativity baseline) turns out to be below 10^{-15} , it does not affect our bounds. In other words, if any modeling residual from J_2 exceeded 10^{-15} , the right side of Eq. (19) should be replaced by the total residual error budget, which would accordingly weaken the bound. In SM, we show that this is not the case.

Results—Let us specialize Eqs. (15), (17), and (19) to the three screening mechanisms of interest. For experiments around the Earth, we have $\Phi_N = \Phi_{N,\oplus} \sim 7.4 \times 10^{-10}$; moreover, we approximate the local Galactic ambient density as $\rho_\infty \sim 10^{-6} \text{ eV}^4$ [56,159].

Chameleon screening: Here we adopt the widely used dark-energy normalization $\Lambda = \Lambda_{\text{DE}} \sim 2.4 \text{ meV}$ [180]. This choice ensures that the chameleon field can act like a quintessence component and generate cosmic acceleration on large scales. It simultaneously simplifies the parameter space so that only the power index n and the coupling β_m need to be specified. Existing bounds on n and β_m can be found, e.g., in Fig. 6 of Ref. [157]. As shown there, for $n \geq 1$ a large part of the parameter space is already excluded by torsion balance measurements [204], neutron interferometry [205,206], and astrophysical constraints (Cepheid variable stars [207] and rotation curve tests [208]), leaving the window $1 \lesssim \beta_m \lesssim 100$ still viable. Motivated by this, we concentrate on the relatively unconstrained region given by $0.1 \lesssim n \lesssim 1$ and $1 \lesssim \beta_m \lesssim 100$. A plot similar to Fig. 6 of Ref. [157] can be found in Fig. 1(a) of Ref. [209], which also illustrates the improvement in interferometric bounds obtained by incorporating the projected sensitivity of CANNEX.

The constraints in our case can be inferred by plugging Eqs. (2), (3), and (4) into Eqs. (15), (17), and (19). In Fig. 1, we show a contour plot comparing the constraints from the three experiments considered here, together with the constraint from Cassini (laboratory bounds are not shown because they do not exclude any portion of the parameter space presented here [157]).

It is worth commenting on how the strength of the constraints depends on the source potential of the experiment. It is established that Solar System light-deflection experiments such as Cassini provide the tightest existing limits on the PPN parameter γ . However, these measurements probe the gravitational field of the Sun, whose deep potential well renders it strongly self-screened. Because the Sun is much more compact than the Earth, the two bodies exhibit very different screening efficiencies: the Earth's surface potential is about three orders of magnitude smaller, making it far less effective at suppressing scalar charges. As a consequence, the effective γ parameter probed by near-Earth experiments such as GP-B can deviate much more strongly from unity than the value probed in the solar field. Thus, although the Cassini constraint on γ is tighter, its translation into bounds on model parameters can make

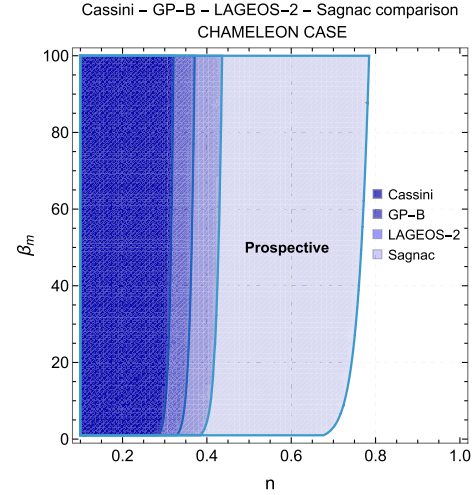


FIG. 1. Constraints on the chameleon parameter space in the plane (n, β_m) for $\Lambda = \Lambda_{\text{DE}} \sim 2.4 \text{ meV}$. The shaded (colored) regions indicate the portions of parameter space that are excluded by the different experiments considered here, together with the Solar System light-deflection constraint derived from the Cassini experiment [159]. In the Sagnac case, we assume a satellite orbit radius R_{orb} corresponding to an altitude of approximately 500 km above Earth's surface.

Earth-orbit experiments equally or more constraining; this contrast in source potentials highlights why GP-B constitutes a powerful probe of screening mechanisms. A similar reasoning applies to the LAGEOS-2 experiment. As for the Sagnac experiment, which would provide the strongest constraint (see Fig. 1), this advantage arises from the high precision with which time differences can be measured, thanks to rapid advances in atomic-clock technology.

Symmetron screening: Here we examine the subspace spanned by M_{sym} and λ , fixing the tachyonic mass to two representative values: $\mu = 1 \text{ meV}$ and $\mu = 1 \text{ eV}$. Specifically, we focus on the ranges $5 \leq \log_{10}(M_{\text{sym}}/\text{GeV}) \lesssim 16$ and $-30 \leq \log_{10}\lambda \lesssim -7$. As inferred from Fig. 10 of Ref. [157], Fig. 2 of Ref. [209], and the constraint from Mercury's perihelion shift [159], this region remains largely unconstrained. By contrast, the rest of the parameter space is tightly bounded by torsion-balance experiments [115], atom interferometry [210], precision neutron tests [209], spectroscopy of hydrogen and muonium, the electron (g-2) [92], gravity-resonance spectroscopy (qBounce) [124,127,209,211], and the projected sensitivity of CANNEX [209], as well as by Mercury's perihelion shift (not displayed in Fig. 2 of Ref. [209]).

Constraints on the parameter space are obtained by substituting Eqs. (6), (7), and (8) into Eqs. (15), (17), and (19). In Fig. 2, we show two contour plots (fixing $\mu = 1 \text{ meV}$ and $\mu = 1 \text{ eV}$) comparing the constraints from the three experiments considered, alongside the bound from Mercury's perihelion shift [159] (also in this case, we omit laboratory limits as they do not restrict the parameter region displayed [157,209]). As μ increases, the model moves

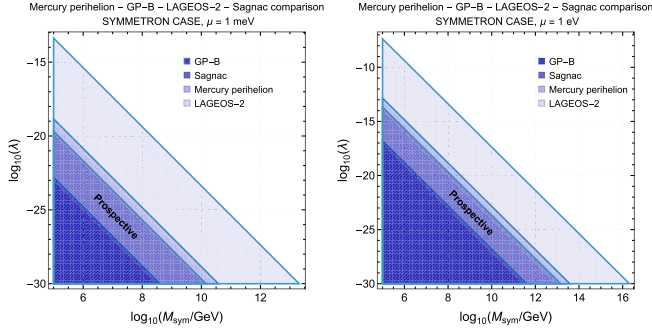


FIG. 2. Constraints on the symmetron parameter space in the plane $[\log_{10}(M_{\text{sym}}/\text{GeV}), \log_{10}(\lambda)]$ with $\mu = 1 \text{ meV}$ (left panel) and $\mu = 1 \text{ eV}$ (right panel). Both axes are shown on a base-10 logarithmic scale. Shaded (colored) regions indicate exclusions from GP-B, LAGEOS-2, Sagnac, and the bound from Mercury’s perihelion shift [159]. For Sagnac, we assume $R_{\text{orb}} \sim 500 \text{ km}$.

deeper into the symmetry-broken regime, and the ambient field value rises. Screening becomes less efficient, so the predicted deviations grow; accordingly, the exclusion contours shift upward and to the right (toward larger M_{sym} and λ) and the allowed region shrinks. That LAGEOS-2 yields the tighter bound is expected in symmetron gravity: deviations in γ are suppressed by an extra factor of the source’s compactness Φ_N relative to those in β [see Eqs. (78) and (79) of Ref. [159]]. As a result, tests that constrain β via pericenter advance dominate the parameter bounds, whereas γ -only probes (e.g., light deflection-Shapiro delay as in Cassini) are intrinsically less powerful in this class of models. Consequently, although Earth’s smaller Φ_N partially enhances the effective symmetron-induced shift in γ probed by GP-B and Sagnac, this boost is insufficient to overcome the superior leverage of a pericenter-advance measurement. By contrast, LAGEOS-2 tests a β -sensitive observable (Earth-orbit pericenter precession) and is thus more effective than GP-B within the same slice of parameter space.

Dilaton screening: Considering bounds from Mercury’s perihelion shift [159], precision neutron tests [144], Lunar Laser Ranging [212], and qBounce and CANNEX [209] (the last of which is prospective), we focus here on the largely unconstrained region $-25 \leq \log_{10}\lambda_{\text{dil}} \leq -15$ and $30 \leq \log_{10}A_2 \lesssim 50$. In what follows, we fix V_0 at two representative values, $V_0 = 1 \text{ MeV}^4$ and $V_0 = 10 \text{ MeV}^4$; for the latter, the dilaton plays a significant role on cosmological scales [213].

As in the previous cases, constraints on the dilaton parameter space can be found by inserting Eqs. (10), (11), and (12) into Eqs. (15), (17), and (19). Figure 3 shows the region of dilaton parameter space of interest. The two panels correspond to two different values of V_0 , as discussed above; increasing V_0 raises the background minimum ϕ_∞ linearly [see Eq. (13)], weakening screening effects. Consequently, the allowed region shrinks when

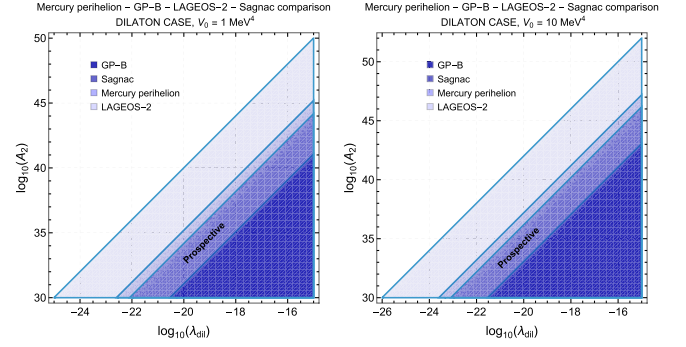


FIG. 3. Constraints on the dilaton parameter space in the plane $[\log_{10}(\lambda_{\text{dil}}), \log_{10}(A_2)]$ with $V_0 = 1 \text{ MeV}^4$ (left panel) and $V_0 = 10 \text{ MeV}^4$ (right panel). Both axes are shown on a base-10 logarithmic scale. Shaded (colored) regions indicate exclusions from GP-B, LAGEOS-2, Sagnac, and the bound from Mercury’s perihelion shift [159]. For Sagnac, we assume $R_{\text{orb}} \sim 500 \text{ km}$.

going from $V_0 = 1 \text{ MeV}^4$ to $V_0 = 10 \text{ MeV}^4$. As in the symmetron case, we expect the LAGEOS-2 bounds to be the most stringent: pericenter advance probes the β combination with a leading correction that scales as $1/\Phi_N^2$, whereas GP-B and Sagnac are essentially γ tests with a $1/\Phi_N$ scaling; hence, the LAGEOS-2 constraint dominates [see Eqs. (92)–(93) in Ref. [159]].

Conclusions—In the symmetron and dilaton cases, the current leader among the tests is LAGEOS-2; this follows from the observable’s β sensitivity and its stronger scaling with Φ_N . For the chameleon case, the projected Sagnac measurement provides the tightest constraint among the tests that we considered. Crucially, if the experimental sensitivity reaches nuclear-clock precision at the $\mathcal{O}(10^{-19})$ level [214], the Sagnac experiment becomes decisively powerful: within our modeling assumptions, such a measurement would exclude the entire region of chameleon parameter space that we considered. Our results underline that experiments in low Earth orbit provide sensitive probes of screened modified gravity.

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Data availability—The data that support the findings of this article are not publicly available. The data are available from the authors upon reasonable request.

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