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010001 **Editorial: Synthesizing current research succinctly and elegantly** Randall Kamien

011001 ***Colloquium*: Superheavy elements: Oganesson and beyond** S. A. Giuliani, Z. Matheson, W. Nazarewicz, E. Olsen, P.-G. Reinhard, J. Sadhukhan, B. Schuetrumpf, N. Schunck, P. Schwerdtfeger

Superheavy atoms and their nuclei are at the forefront of experimental and theoretical nuclear and atomic physics, and chemistry. Because of their large atomic numbers, traditional nuclear and atomic concepts have to be revised in superheavy systems. In this Colloquium the latest developments in the field are described and the route for future scientific explorations in this area of research is indicated.

011002 ***Colloquium*: Anomalous metals: Failed superconductors** Aharon Kapitulnik, Steven A. Kivelson, Boris Spivak

There is no theoretical consensus on the nature of metallic states in two-dimensional materials in the presence of interactions and disorder. Quantum and statistical fluctuations couple to each other in an unusual way that defies the conventional wisdom of the standard Landau-Fermi-Drude model for three dimensions. In this Colloquium the intriguing theoretical and experimental aspects of the anomalous metallic state in two dimensions in the context of the proximity of a superconducting phase transition are discussed.

011003 ***Colloquium*: Roper resonance: Toward a solution to the fifty year puzzle** Volker D. Burkert, Craig D. Roberts

The Roper resonance in the strong interaction spectrum has defied understanding for over 50 years. This puzzling unstable particle appears to be an exact copy of the proton except that its mass is 50% greater. In modern terms, the Roper resonance is the proton's lightest radial excitation, consisting of a dressed-quark core augmented by a cloud of mesons. This Colloquium describes the experimental and theoretical developments that have enabled the picture of the Roper resonance to be drawn.

015001 **Electric dipole moments of atoms, molecules, nuclei, and particles** T. E. Chupp, P. Fierlinger, M. J. Ramsey-Musolf, J. T. Singh

The existence of a nonvanishing electric dipole moment for an elementary particle, atom or molecule, would indicate a violation of time-reversal symmetry and parity-symmetry violation. The latter could help resolve the question of the observed matter-antimatter asymmetry in the Universe. This review provides a broad overview of theoretical motivations and interpretations as well as details about experimental techniques, experiments, and prospects.

015002 **The conformal bootstrap: Theory, numerical techniques, and applications**

David Poland
Slava Rychkov
Alessandro Vichi

Conformal symmetry generalizes scale invariance, the hallmark of continuous phase transitions. The additional symmetry highly constrains correlation functions and imposes an infinite set of "crossing" relations between them. It has now become possible to calculate scaling dimensions, critical exponents, and other quantities by exploiting crossing symmetry. This bootstrap program has in some cases provided accurate predictions for critical phenomena. This review provides a state of the art picture of this program.

015003 **η' and η mesons with connection to anomalous glue**

Steven D. Bass
Pawel Moskal

Properties of hadrons are emergent from the more fundamental quark and gluon degrees of freedom of quantum chromodynamics (QCD). In the hadronic zoo, η and η' mesons are unique laboratories of gluon dynamics: measurements of η and η' production are sensitive to behavior of QCD symmetries at finite density and temperature. This review surveys η and η' meson physics as a probe of QCD dynamics emphasizing recent advances in experiment and theory.

015004 **Magnetic small-angle neutron scattering**

Sebastian Mühlbauer
Dirk Honecker
Élio A. Périgo
Frank Bergner
Sabrina Disch
André Heinemann
Sergey Erokhin
Dmitry Berkov
Chris Leighton
Morten Ring Eskildsen
Andreas Michels

The magnetic spin and charge neutrality of neutrons from cold beam sources provide versatility in probing the properties and structure of a wide variety of materials. This review shows how small-angle neutron scattering (SANS) has been applied to magnetic materials thereby stimulating advances in theory and micromagnetic computer simulations. SANS is effective at revealing nanoscale details of magnetic phase separation and associated inhomogeneities in composite materials. Noncollinear chiral spin structures such as skyrmions, representing topologically stable field configurations with particlelike properties, together with quantized vortices in superconductors are shown to be accessible to SANS characterization.

015005 **Topological bands for ultracold atoms**

N. R. Cooper
J. Dalibard
I. B. Spielman

The existence of band structure and topological invariants that characterize Bloch energy bands have consequences for our understanding of a wealth of phenomena in solid state systems. This article reviews how cold neutral atoms in optical lattices can be exposed to a variety of artificial magnetic field and spin-orbit couplings and allows experimental investigations beyond reach of electron systems in solids.

015006 **Topological photonics**

Tomoki Ozawa
Hannah M. Price
Alberto Amo
Nathan Goldman
Mohammad Hafezi
Ling Lu
Mikael C. Rechtsman
David Schuster
Jonathan Simon
Oded Zilberberg
Iacopo Carusotto

The robustness of the integer quantum Hall effect of electron systems is due to the existence of a topological invariant that characterizes the variation of the electron wave function over the Brillouin zone. Topological phenomena are generic features of waves in periodic media, and this article reviews how photonic systems such as waveguide arrays and photonic metamaterials allow exploration and application of topological effects in new physical regimes and in new devices.

019901 **Erratum: Electron-phonon interactions from first principles [Rev. Mod. Phys. 89, 15003 (2017)]**

Feliciano Giustino