REVIEWS of MODERN PHYSICS

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1197 **Editorial: *Physics* - spotlighting exceptional research** Gene D. Sprouse

1199 **Editorial: APS now leaves copyright with authors for derivative works** Gene D. Sprouse

1201 ***Colloquium*: Unusual resonators: Plasmonics, metamaterials, and random media** Konstantin Y. Bliokh, Yury P. Bliokh, Valentin Freilikher, Sergey Savel'ev, Franco Nori

Waves interacting with one or two coupled open resonators can provide a unified explanation of the following fundamental features: superresolution with flat lenses able to resolve subwavelength detail, extraordinary transmission of thin metal films perforated by subwavelength hole arrays, total absorption in frustrated internal refraction, and localization of electromagnetic waves in disordered materials. Such description successfully quantifies the variety of observed complex behavior via resonator parameters: eigenfrequencies, Q factors, and coupling coefficients.

1215 **Theory of ultracold atomic Fermi gases** Stefano Giorgini, Lev P. Pitaevskii, Sandro Stringari

The creation of quantum degenerate atomic Fermi gases has given rise to a new intersection between atomic physics and condensed matter physics. This article describes the essential theory for understanding these gases and compares the theoretical description with experimental observations whenever possible. Topics include the BCS limit of ordinary Fermi superfluidity, the Bose-Einstein condensation (BEC) of dimers and the unitary limit of large scattering length. Physical properties include the density profiles and the energy of the ground-state configurations, the momentum distribution, the fraction of condensed pairs, collective oscillations and pair breaking effects, the expansion of the gas, the main thermodynamic properties, the behavior in optical lattices, and various signatures of superfluidity. Theoretical approaches range from the mean-field description of the BCS-BEC crossover to nonperturbative methods based on quantum Monte Carlo techniques.

1275 **Critical phenomena in complex networks** S. N. Dorogovtsev, A. V. Goltsev, J. F. F. Mendes

Networks whose architecture is more complex than random graphs are ubiquitous, from the World Wide Web to cellular networks, and display unusual critical phenomena driven by strong inhomogeneity. This review provides a broad perspective on cooperative models defined on networks, their phase transitions and collective effects, and aspects of dynamics such as synchronization.

1337 ***Colloquium*: Andreev reflection and Klein tunneling in graphene** — C. W. J. Beenakker

This Colloquium describes the underlying physics of two electronic processes that occur in a carbon monolayer (graphene): the electron-to-hole conversion at an interface with a superconductor (Andreev reflection) and the tunneling through a p-n junction (Klein tunneling). Both processes have an analog in relativistic quantum mechanics, and the excitations occurring in each of them are described by a variant of the Dirac equation for massless fermions. Furthermore, the chiral tunneling in normal and superconducting junctions in graphene is discussed from a unified perspective.

1355 **Anderson transitions** — Ferdinand Evers, Alexander D. Mirlin

Anderson localization, and the related metal-insulator transitions, have a long history and are important in a variety of physical situations, from doped semiconductors to quantum Hall systems. In this review, an update on recent developments on this important topic is provided, including the nature of the wave functions at criticality, the symmetry classification of various models, and the dependence on the spatial dimensionality.

1419 **Conifolds and geometric transitions** — Rhiannon Gwyn, Anke Knauf

An active area of research in modern string theory concerns understanding how singular geometries are smoothed out (or "resolved"). An important example, called the "conifold singularity," can be explored using an arsenal of string-theoretic tools including D-brane probes and the famous AdS/CFT duality, which relates string theory in anti–de Sitter (AdS) geometries and conformally invariant field theories (CFT). As a certain parameter is varied, one smoothed out geometry can morph into a different one.

1455 **Color superconductivity in dense quark matter** — Mark G. Alford, Andreas Schmitt, Krishna Rajagopal, Thomas Schäfer

This article surveys the color superconducting phases that are expected in quark matter at high density and low temperature. Starting at the highest densities, where a rigorous QCD description is possible, the phases in various density regimes, their properties, and the theoretical tools for describing them are reviewed. Applications to neutron stars and implications for observational consequences are discussed.

1517 **Nobel Lecture: Origin, development, and future of spintronics** — Albert Fert

1531 **Nobel Lecture: From spin waves to giant magnetoresistance and beyond** — Peter A. Grünberg

The 2007 Nobel Prize for Physics was shared by Albert Fert and Peter Grünberg. These papers are the text of the address given in conjunction with the award.

Forthcoming articles