REVIEWS of MODERN PHYSICS

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315 **Half-metallic ferromagnets: From band structure to many-body effects**

M. I. Katsnelson
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A. I. Lichtenstein
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Ferromagnetism, which spontaneously spin polarizes the conduction electrons, offers a fascinating possibility: a material can be a semiconductor for one spin projection, and a metal for the other. This review gives an overview of this class of materials, their electronic structure, and their transport and thermodynamic properties.

379 ***Colloquium*: Chaotic quantum dots with strongly correlated electrons**

R. Shankar

Collections of large quantum dots—basically large artificial atoms fixed on a substrate—have aggregate properties that are best treated with statistical approaches. This Colloquium describes important theoretical tools for this purpose, particularly the renormalization group and random matrix theory.

395 **Numerical renormalization group method for quantum impurity systems**

Ralf Bulla
Theo A. Costi
Thomas Pruschke

Wilson's renormalization group was initially designed to apply to a broad class of problems in condensed matter physics, but became best known for its applications to critical phenomena, where perturbative analytic methods can be employed. This article reviews work that revives the original spirit of the renormalization group, namely, solving the full, nonlinear, renormalization-group equations numerically.

451 **Electron scattering from argon: Data evaluation and consistency**

E. Gargioni
B. Grosswendt

The need is growing for accurate electron scattering cross section data in order to understand electron transport in matter, to address problems in plasma physics, astrophysics, and atmospheric physics, and for applications such as surface and materials analysis, detector response studies, and radiation dosimetry. Although a considerable body of data exists on electron scattering, the fundamental datasets that encompass recent experimental results have often been neglected. Using atomic argon as an exemplar, the authors demonstrate methods for verifying consistency between datasets on the basis of theoretical requirements, minimizing systematic errors on the basis of cross-checks from independent measurements, and understanding the impact of systematic errors on theoretical analyses.

481 **Double beta decay, Majorana neutrinos, and neutrino mass**

Frank T. Avignone III
Steven R. Elliott
Jonathan Engel

The answer to the question "Is the neutrino its own antiparticle?" is important, both for developments and tests for theories of particle mass and for uncovering the reasons why matter dominates over antimatter in our Universe. Neutrinoless double-beta decay of which the present status of experimental and theoretical issues are reviewed will have the best sensitivity to the neutrino mass of any laboratory technique and is also the only practical approach for investigating the particle/antiparticle problem. The increasing sensitivity of experiments and improvements in nuclear theory outlined in this review thus make the future exciting for this field at the interface of nuclear and particle physics.

517 **Entanglement in many-body systems**

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Vlatko Vedral

Quantum entanglement is the basic ingredient in many applications in quantum information processing. Recently, it has been recognized that this intriguing property also offers a new perspective in the investigation of many-body quantum systems. This paper reviews the theoretical tools that have been developed in the context of quantum information to describe and quantify entanglement, and applies them to the study of many-body systems, with special emphasis in its role of phase transitions.

577 ***CP* violation from the standard model to strings**

Tarek Ibrahim
Pran Nath

This review surveys the broad subject of *CP* violation, including its possible origins in the standard model and in extensions ranging from supersymmetry to extra dimensions and string theory. The physical implications, experimental status, and future prospects for K and B decays, electric dipole moments, neutrino physics, the baryon asymmetry, and collider physics, especially in the supersymmetric extension of the standard model, are reviewed.

633 **CODATA recommended values of the fundamental physical constants: 2006**

Peter J. Mohr
Barry N. Taylor
David B. Newell

This review of the fundamental constants provides recommended values and their associated uncertainties, updating the last review of 2002. Since that time, new data and methods have led to a significant reduction in the uncertainties of many previously recommended values. For example, the uncertainty of the fine structure constant α has been reduced by nearly a factor of five and the one of Planck's constant h by over a factor of three. The outlook and suggestions given for future work will certainly spark several ambitious experiments from various groups.

Forthcoming articles