REVIEWS of MODERN PHYSICS

Volume 79 **Number 4** **October–December 2007**

1139 **Supersymmetric solitons**

M. Shifman
A. Yung

This article surveys the origins and properties of critical (so-called Bogomol'nyi-Prasad-Sommerfeld saturated) solitons such as domain walls, non-Abelian strings, and monopoles. Supersymmetric gauge theories in two, three, and four dimensions are considered. The relationship to topics in string theory, such as D branes, is pointed out. The techniques and insights described here provide a deeper understanding of the phenomenon of confinement in quantum chromodynamics.

1197 ***Colloquium*: Momentum of an electromagnetic wave in dielectric media**

Robert N. C. Pfeifer
Timo A. Nieminen
Norman R. Heckenberg
Halina Rubinsztein-Dunlop

The transport of energy and momentum through vacuum by radiation, as embodied in the electromagnetic energy-momentum tensor, is a well understood property of electromagnetic radiation, in both classical and quantum descriptions. In the latter the basic field increments, photons, carry increments of energy and momentum. When radiation enters a dielectric medium, one must anticipate further transport of energy and momentum, but the details and interpretations have remained subject to dispute for more than a century. This Colloquium reviews the many proposed definitions, and stresses the importance of defining concomitantly an appropriate energy-momentum tensor for the material. It explains how, when these definitions are made consistently, there is no way to distinguish the alternatives experimentally. Illustrative examples clarify the interpretation of various experiments and offer guidance for calculation of observable effects.

1217 **Spins in few-electron quantum dots**

R. Hanson
L. P. Kouwenhoven
J. R. Petta
S. Tarucha
L. M. K. Vandersypen

This review describes experiments on single-electron spins confined in quantum dots, which are nanometer-scale boxes defined in a semiconductor host material. Explanations of the underlying physics and the discussion of electrical characterization and manipulation of single and double quantum dot systems containing one or two electrons enable a comprehensive understanding of single spin dynamics in a solid-state environment.

1267 ***Colloquium*: Light scattering by particle and hole arrays**

F. J. García de Abajo

The transmission of light through a small aperture becomes negligible when the opening is much smaller than a wavelength. However, periodic arrays of small holes can dramatically alter the single-opening property, even allowing complete transmission. Similar collective effects occur for reflection from arrays of small particles: complete reflection is detected in this case even though the particles are smaller than a wavelength. This Colloquium describes the various effects observable from such periodic arrays and presents a simple theoretical model, of dipole arrays, which provides an explanation of the effects.

1291 **Near-field radiative heat transfer and noncontact friction**

A. I. Volokitin
B. N. J. Persson

The fluctuating electromagnetic field that surrounds any solid is responsible for important effects such as the radiative heat transfer, van der Waals force, and van der Waals, or noncontact, friction. This review gives an overview of these phenomena, and shows how experimental data on noncontact friction can be explained by effects originating in the near-field region of the fluctuating field.

1331 **Nobel Lecture: From the Big Bang to the Nobel Prize and beyond**

John C. Mather

The 2006 Nobel Prize for Physics was shared by John C. Mather and George F. Smoot. These papers are the text of the addresses given in conjunction with the award.

1349 **Nobel Lecture: Cosmic microwave background radiation anisotropies: Their discovery and utilization**

George F. Smoot

1381 **Progress in the measurement and modeling of physisorbed layers**

L. W. Bruch
R. D. Diehl
J. A. Venables

This review describes recent advances in understanding the underlying physical processes that determine the properties of physisorbed layers of rare gases, alkanes, and diatomic molecules on metal and dielectric surfaces. The detailed information gleaned from advanced experimental techniques provides comprehensive information on adsorbate interactions and diffusion, adsorption sites, collective excitations, lattice dynamics, molecular orientations, and film growth.

1455 **Publisher's Note: Spins in few-electron quantum dots [Rev. Mod. Phys. 79, 1217 (2007)]**

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