Reviews of Modern Physics

Volume 72 **Number 4** **October 2000**

895 **The statistical theory of quantum dots** — Y. Alhassid

The quantum limits of electrical conduction are revealed in quantum dots, the sub-micron-scale devices that hold up to several thousand electrons. This review describes the observed conduction phenomena and their statistical properties, which reflect the presence of one-body chaos, quantum interference, and electron-electron interactions.

969 **Pairing symmetry in cuprate superconductors** — C. C. Tsuei, J. R. Kirtley

The symmetry of the order parameter of high-temperature superconductors, which is predominantly *d*-wave, has been of interest for both fundamental and applied reasons. This review discusses the underlying concepts and issues of pairing symmetry as well as the current status of the major experimental studies, which include both phase-sensitive measurements and symmetry-sensitive studies that do not measure phase directly.

1017 **Nematic liquid crystals as a new challenge for radiative transfer** — Bart van Tiggelen, Holger Stark

Radiative transport in anisotropic media requires a more elaborate theory than the familiar diffusion equation that has served well in the past. This review shows how the theory is generalized, starting from a fundamental Green's function approach, and taking nematic crystals as an example.

1041 **Real-space mesh techniques in density-functional theory** — Thomas L. Beck

The practical application of density functional theory requires efficient numerical techniques to solve the variational equations. This review describes various grid-based methods and shows the advantage of the multiscaling technique under certain circumstances.

1081 **Geodynamo theory and simulations** — Paul H. Roberts, Gary A. Glatzmaier

The origin of the magnetic field of the Earth has been a mystery for more than 3000 years. The basic explanation was proposed in the early 20th century, but not until recently have computers become

capable of solving the full set of MHD equations that describe the geodynamo. As discussed in this review, the current models are rather successful in accounting for the observed characteristics of the geomagnetic field.

1125 Review of speculative ''disaster scenarios'' at RHIC — R. L. Jaffe, W. Busza, F. Wilczek, J. Sandweiss

The Relativistic Heavy-Ion Collider (RHIC) at Brookhaven has just begun operation. It will explore new domains of particle and energy density. Questions have been raised about possible cataclysmic events at such a collider. The authors analyze speculative disaster scenarios and argue that they are ruled out either by strong physics arguments, empirical data, or both.

RMP COLLOQUIA

1141 Studying the top quark — S. Willenbrock

The top quark, discovered in 1995, was found to be surprisingly more massive than all other quarks. Consequently top quark interactions are free of many of the complications of the strong interaction. This Colloquium surveys current knowledcge of top quark physics and outlines the goals of future experiments.

1149 Why the universe is just so — Craig J. Hogan

Of the 20 parameters of the standard model, there are only a few for which slightly different values would result in a universe with vastly different physics. This article examines which aspects of astrophysics and cosmology are fixed by symmetry and which aspects are particularly sensitive to fine tuning of the standard model. The conspicuous effects of slight changes in the up and down quark masses suggest that these parameters in particular might be determined by anthropic selection.

1163 Forthcoming articles

1165 Volume table of contents

1167 Summary of the PACS scheme—2000

1170 Subject index to volumes 68–72, 1996–2000

1183 Author index to volumes 68–72, 1996–2000

Cumulative listing of reprints