Reviews of Modern Physics

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685 **The manipulation of neutral particles** Steven Chu

707 **Manipulating atoms with photons** Claude N. Cohen-Tannoudji

721 **Laser cooling and trapping of neutral atoms** William D. Phillips

The 1997 Nobel Prize in Physics was shared by Steven Chu, Claude N. Cohen-Tannoudji, and William D. Phillips. These papers are the texts of their addresses on the occasion of the award.

743 **Structure and dynamics of few-nucleon systems** J. Carlson, R. Schiavilla

Few-nucleon physics is a field rich with high-quality experimental data and possibilities for accurate calculations of strongly correlated quantum systems. The review covers most aspects of these systems, including binding energies, scattering and capture, electromagnetic properties, and response. One finds that the theory of light systems is limited more by the knowledge of three-body forces than by computational uncertainties.

843 **Nuclear structure in odd-odd nuclei, $144 \leqslant A \leqslant 194$** A. K. Jain, R. K. Sheline, D. M. Headly, P. C. Sood, D. G. Burke, I. Hrivnácová, J. Kvasil, D. Nosek, R. W. Hoff

The complex aspects of odd-odd nuclei simplify when the nucleus is deformed, yet new features emerge in the rotational band structures. This review considers the present understanding of intrinsic and rotational band structures with an emphasis on the role of the *p-n* residual interaction in determining the characteristics of the bands.

897 **Magnetic, transport, and optical properties of monolayer copper oxides** M. A. Kastner, R. J. Birgeneau, G. Shirane, Y. Endoh

Copper oxides containing CuO_2 layers are intriguing because of their unusual properties, including two-dimensional antiferromagnetism when the layers are pure and superconductivity when they are doped. In this article the authors review results of neutron, optical, transport, and magnetization measurements made on large single crystals. The goal is to characterize the fundamental magnetic and charge excitations in these materials and their dependence on doping, with a view toward understanding the mechanism of high-temperature superconductivity.

929 **Quantum diffusion of muons and muonium atoms in solids**
Vyacheslav G. Storchak
Nikolai V. Prokof'ev

One of the most intriguing phenomena in physics is the tunneling of massive particles through potential barriers, a typical quantum effect. A favorable situation for studying this quantum diffusion is met in the transport of positive muons or muonium atoms in solids, because their masses are intermediate between those of electrons and common atoms. This article reviews the present knowledge from both experimental and theoretical investigations of the diffusion of positive muons in metals, in both normal and superconducting states, and of muonium in semiconductors and insulators. The main sources for influencing the tunneling process in the solid-state environment are discussed.

979 **The uses of quantum field theory in diffusion-limited reactions**
Daniel C. Mattis
M. Lawrence Glasser

The use of quantum field theory techniques in the investigation of the dynamic behavior of strongly interacting, classical (i.e., non-quantum-mechanical) objects constitutes a powerful and natural, yet not widely known, approach to the study of the stochastic behavior of these systems. The authors present a comprehensive review of this field, its historical development and an extensive bibliography. Illustrative examples include aggregation, pattern formation, vacancy-interstitial recombination, and exciton diffusion in an aleatory medium.

RMP Colloquia:

1003 **Coherent population transfer among quantum states of atoms and molecules**
K. Bergmann
H. Theuer
B. W. Shore

The method of stimulated Raman adiabatic passage for transferring a system's population completely from an initial state to a final state is described. It employs two coherent laser pulses, which connect the initial and final states via an intermediate state. However, unlike conventional ''pump and dump'' schemes (which achieve a 25% population transfer to the final state), the stimulated Raman method has none of the usual losses to spontaneous emission from the intermediate state and no population remaining in the initial state, thereby achieving in principle a 100% population transfer.

1027 **Single-photon detection by rod cells of the retina**
F. Rieke
D. A. Baylor

Rod photoreceptors in the eye reliably detect the absorption of a single photon and produce responses which allow one absorbed photon to be distinguished from two. This review describes experimental evidence for the high sensitivity of rod photoreceptors and the biophysical basis for this sensitivity.

1037 **Forthcoming articles**