Reviews of Modern Physics

Volume 72 Number 2 April 2000

333 **Nobel Lecture: A confrontation with infinity** Gerard 't Hooft

341 **Nobel Lecture: From weak interactions to gravitation** Martinus J. G. Veltman

The 1999 Nobel Prize in Physics was shared by Gerard 't Hooft and Martinus J. G. Veltman. These papers are the texts of their addresses on the occasion of the award.

351 **CODATA recommended values of the fundamental physical constants: 1998** Peter J. Mohr, Barry N. Taylor

This review of the fundamental constants provides recommended values and the associated uncertainties, updating the last review of 1986. Due to improved precision in more recent measurements, most uncertainties have decreased greatly, typically by an order of magnitude.

497 **The theory of two-electron atoms: between ground state and complete fragmentation** Gregor Tanner, Klaus Richter, Jan-Michael Rost

The authors survey progress, starting from the earliest days of quantum mechanics, in describing correlated, two-electron states of atoms. Such states exhibit approximate dynamical symmetries and corresponding quantum numbers whose discovery and elucidation have required novel theoretical approaches. Emphasis is placed on recent progress stemming from modern semiclassical concepts.

545 **Intense few-cycle laser fields: Frontiers of nonlinear optics** Thomas Brabec, Ferenc Krausz

Recent progress in ultrafast optics has made possible the generation of ultraintense light pulses consisting of only a few optical oscillation cycles. The short rise time of these pulses exposes the bound electrons to external field strengths many times higher than the binding Coulomb field, thus extending the frontiers of nonlinear optics to a new regime of extremely high light intensities. This article reviews the development of ultrashort-pulse physics and the technology of ultrashort-pulse lasers with particular emphasis on high-

order harmonic generation and single subfemtosecond pulse generation at the shortest wavelengths.

593 **Energetics of Si(001)** H. J. W. Zandvliet

The stability of surfaces and growth of crystals is understood in terms of the energies associated with surface steps and their interaction. This article reviews how the fundamental energetic parameters can be determined from analysis of surface images, using the scanning tunneling microscope. The approach is demonstrated for the silicon (001) surface, which is especially well characterized because of its technological importance.

RMP COLLOQUIUM

603 **The onset of shear flow turbulence** Siegfried Grossmann

A long-standing puzzle in the understanding of turbulence is its onset despite linearly stable laminarity. However, hydrodynamics allows certain small disturbances to grow to large amplitudes before decaying, thus triggering nonlinear interaction. This Colloquium explains with simple models how this works and how it can give rise to self-sustained turbulence.

619 **Forthcoming articles**