Reviews of Modern Physics

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995 **Synthesis of the elements in stars: forty years of progress**

George Wallerstein
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Since publication of the pioneering article ''Synthesis of the Elements in Stars'' by Burbidge, Burbidge, Fowler, and Hoyle, much progress has been made in elucidating the processes that make up stellar nucleosynthesis. At the same time, progress in observational technology has allowed astronomers to both validate and challenge these basic ideas. Significant gaps in our knowledge of stellar burning still remain, from the synthesis of the light elements early in the lives of stars to the late stages of stellar evolution where the heaviest elements are produced.

1085 **Recoilless gamma-ray lasers**

George C. Baldwin
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There have been many proposals for making lasers with nuclear gamma-ray transitions, so far unsuccessful. This article reviews the underlying physics in the various graser schemes and the fundamental obstacles that have prevented their realization of them up to now. The authors also suggest the promising approaches for future development.

1119 **Heavy-fermion systems studied by μSR technique**

A. Amato

Materials based on *f*-shell metals can have a very complex electronic structure, with one of the manifestations being orders-of-magnitude enhancement of the effective mass of conduction electrons. Muon spin rotation (μSR) has proven to be a powerful tool for studying the character of these systems, answering questions about magnetic properties, the coexistence of different phases, and the form of superconductivity. This review discusses in detail the physics of heavy-fermion systems that has been learned from μSR.

1181 **Theory of color symmetry for periodic and quasiperiodic crystals** — Ron Lifshitz

Color symmetry groups are powerful abstract tools which can be used for the classification of properties such as alloy ordering and magnetic phases in solids. The discovery in the 1980s of the icosahedral quasicrystals showed that crystallographic symmetries exist without translational invariance of the solid. In this article the author derives the general theory of color symmetries using a Fourier-space method, providing a classification scheme for color groups applicable to all crystals and quasicrystals.

1219 **Immunology for physicists** — Alan S. Perelson, Gérard Weisbuch

The immune system is a complex system of cells and molecules, and insights into its behavior may be obtained by using methods and concepts from statistical physics. The authors give an introduction to the biology of the immune system and then describe a number of problems that have been better understood through physical concepts and mathematical methods.

RMP Colloquium:

1269 **Modeling molecular motors** — Frank Jülicher, Armand Ajdari, Jacques Prost

Proteins that convert chemical energy to mechanical work can be regarded as isothermal molecular motors. This article presents a generic and simple model to describe the physics of one type of such motors that generates motion along a linear and periodic structure. The model is applied to both individual motors and to collections of motors operating cooperatively. While the former case is reminiscent of proteins involved in material transport in cells, the latter is inspired by the organization of muscle fibers.

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