Reviews of Modern Physics

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337 **A dying universe: the long-term fate and evolution of astrophysical objects**

Fred C. Adams
Gregory Laughlin

Long after conventional stellar evolution has ceased, our universe will continue to evolve on a greatly slowed-down time scale. This article discusses the fascinating physical processes that come into play during the prolonged cosmic endgame. Dead stars will become the source of dynamics, producing new stars by collisions, and converting dark matter to radiation. Depending on the stability of the proton, the final state is not approached until 10^{100} years.

373 **Reconstructing the inflaton potential—an overview**

James E. Lidsey
Andrew R. Liddle
Edward W. Kolb
Edmund J. Copeland
Tiago Barreiro
Mark Abney

The structures in our universe—galaxies, clusters, and superclusters—are thought to have evolved from small-amplitude irregularities imprinted during an inflationary phase. Such irregularities also manifest themselves as non-uniformities in the temperature of the microwave background radiation over the sky; they also may create a background of primordial gravitational waves. The authors discuss how cosmological measurements can be used to constrain the physics of the ultra-early universe.

411 **Nuclear reaction rates in a plasma**

Lowell S. Brown
R. F. Sawyer

The effect of a plasma environment on nuclear reactions is of interest in astrophysics and elsewhere, but a consistent calculational formalism has been lacking. Brown and Sawyer apply here the techniques of quantum statistical mechanics to make a general calculational framework. The formalism is illustrated with examples showing how some well-known special cases may be derived.

437 **Improving the resolution of ground-based telescopes**

Michael C. Roggemann
Byron M. Welsh
Robert Q. Fugate

Atmospheric turbulence degrades the angular resolution of ground-based optical telescopes. This paper discusses the physical processes that distort the incoming wave front and reviews and assesses various methods for achieving diffraction-limited imaging, involving sophisticated image processing and novel hardware.

507 **Nonlinear wave collapse and strong turbulence** P. A. Robinson

The nonlinear behavior of plasma and other waves can lead to self-focusing and trapping of the waves. Wave collapse can occur in three dimensions where nonlinearities are stronger than in one dimension, where they only lead to soliton formation. One key signature of wave collapse is strong turbulence in plasmas. Many insights into collapse and strong turbulence have been obtained from numerical simulations in recent years. Such phenomena have also been observed in many plasma environments ranging from astrophysical plasmas to the ionosphere to laboratory experiments.

575 **Superconductivity in fullerides** O. Gunnarsson

The discovery of fullerenes, slightly over a decade ago, has inspired a new field of research focused on unraveling the remarkable properties of these novel carbon molecules. This article presents a comprehensive review of experimental and theoretical work involved with understanding the superconducting properties of the fullerenes. Special attention is given to an extensive analysis of the possible mechanisms for this superconductivity.

607 **The microscopic magnetization: concept and application** L. L. Hirst

The magnetization is obviously one of the basic physical properties characterizing the status of condensed matter. Depending on the experimental situation, the term magnetization is used either on a macroscopic or on a microscopic level. With the present tutorial review the author bridges these two limits to clarify the concepts. An important application is determining the magnetization from measured amplitudes of magnetic neutron scattering.

RMP Colloquium:

629 **Spin-exchange optical pumping of noble-gas nuclei** Thad G. Walker
William Happer

New technologies have been made possible by the availability of liter quantities of spin-polarized noble gases, but the achievement of such polarizations is a high experimental art. Walker and Happer discuss the multitude of competing atomic, molecular, and optical processes that must be harnessed in order to transfer polarization efficiently from laser light to the noble-gas nuclei. As well as reviewing the current state of the art, they point out fruitful areas for future research.

643 **Forthcoming articles**

Cumulative listing of reprints