Russian social theorists (some might be called early sociologists) were particularly imaginative in incorporating evolutionary perspectives into their accounts of society and morals.

From outside the framework Vucinich established for his study, some of the theories put forward by non-orthodox Russian Darwinians could be viewed as anticipations of present concerns in evolutionary theory. Several current controversies have interesting antecedents in the Russian tradition. (For a recent discussion along these lines see Daniel Todes, "Darwin's Malthusian metaphor and Russian evolutionary thought," *Isis*, December 1987, pp. 537–51, and Stephen Jay Gould, "Kropotkin was no crackpot," *Natural History*, July 1988, pp. 12–21.) As documented by Vucinich, the Russian tradition of Darwinist thought was a rich and solid one, interestingly distinct in several respects from the more familiar Western one and until now relatively unknown and inaccessible to English-speaking scientists.

Readers interested in Vucinich's work may also wish to see Daniel Todes's just-published *Darwin without Malthus: The Struggle for Existence in Russian Evolutionary Thought* (Oxford University Press) and Kendall Bailes's forthcoming *Science and Russian Culture in an Age of Revolution: V. I. Vernadsky and His Scientific School, 1863–1945* (Indiana University Press).

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## Solar Physics

**The Physics of Solar Flares.** EINAR TANDBERG-HANSSEN and A. GORDON EMSLIE. Cambridge University Press, New York, 1988. xiv, 273 pp., illus. $69.50. Cambridge Astrophysics Series.

Look out! Flares are coming! The number of sunspots (and hence of solar flares) present on the sun varies in time with an 11-year periodicity, and the current unusually rapid rise in sunspot number toward a new maximum in 1990 has led to speculation that it may be a record-breaker. Sunspots are regions of very strong magnetic field, and it is the dramatic conversion of magnetic energy into heat, mass motions, and fast particle energy that produces a flare.

Already this year the appearance of a historic sunspot group stretching across the solar disc and the resulting great solar flare of 13 March have added to the excitement. The effects two days later when the material from the flare had reached and bombarded the earth's magnetic field have made newspaper headlines in many countries. These effects include a large geomagnetic substorm with the earth's magnetic field changing in time and driving electric current through the national grid in Canada, tripping safety mechanisms and causing a power cut in the whole of Quebec; a great aurora that was spectacular here in Scotland and was seen as far south as Italy and Jamaica; the slowing down of the Solar Maximum Mission space satellite, whose altitude fell by a kilometer; an 8-degree swing in compass readings; distortion of television and radio communications; and problems with delicate magnetic sensors used by oil companies to steer drill heads. The flare has also been mentioned as a possible cause for problems with space shuttle computers that brought an early end to a mission and for difficulties with the sensitive electronics of railway signals.

The subject of solar flares is an enormous one and involves the coming together of most of the skills of solar physicists. As well as combining the knowledge of observers, interpreters, and theorists, a flare specialist needs to understand how radiation across the electromagnetic spectrum from $\gamma$-rays to radio waves is produced and how the many different kinds of flare are formed.

With the imminence of the next sunspot maximum and the resulting renewal of research activity on solar flares, the time is certainly ripe for a new book on the subject to summarize our present knowledge for new graduate students. Formidable as the task is, the present authors, one an expert on optical and ultraviolet observations and the other an expert on the impulsive phase, succeed admirably.

The book has a chapter each on spectroscopy, magnetohydrodynamics, kinetic plasma physics, and radiation transport theory. These are followed by a chapter on each of the four main parts of the flare phenomenon: the preflare phase, when a magnetic region is preparing for the great event and shows symptoms of being "with flare"; the impulsive phase, when the flare is born and there is a rapid rise in intensity and an acceleration of particles to high energies; the gradual phase, when the intensity of optical and soft x-ray emission slowly declines; and the coronal mass ejection, sometimes involving the ejection of an enormous mass of material.

A slight weakness of the book is in its treatment of the behavior of the magnetic field, described by magnetohydrodynamics (MHD). Only half of the chapter on MHD in fact deals with MHD. The section on magnetoacoustic waves deals instead with Alfvén waves and incorrectly suggests that the perturbation equations about a potential field can be Fourier analyzed. Furthermore, the book does not proceed to apply the MHD tools to understand how the magnetic field loses equilibrium or goes unstable and creates the flare in the first place or to explain how magnetic reconnection as the open field closes back down can produce the continued substantial energy release in the gradual phase.

Although great advances in understanding solar flares have been made in the past ten years, there are many basic questions remaining to be answered. This book gives an excellent overview of most of the main aspects of flare physics and is highly recommended for those entering the subject or wanting an up-to-date account of this fundamental topic in astrophysics.

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## The $\pi$ Meson

**Pions and Nuclei.** TORLEIF ERICSON and WOLFRAM WEISE. Clarendon (Oxford University Press), New York, 1988. xvi, 479 pp., illus. $125. International Series of Monographs on Physics, vol. 74.

The $\pi$ meson, or pion, the lightest of the strongly interacting elementary particles, was discovered in 1947. The nuclear shell model, which was the first systematic description of nuclear structure based on protons and neutrons (nucleons), emerged the following year. The role that pions play in nuclear structure and the way in which nuclei display aspects of pion dynamics are subjects that form a bridge between elementary particle and nuclear physics and that are under active study.

Nuclear pion physics encompasses a large variety of phenomena, including nucleon-nucleon interactions, magnetic properties of nuclei, pionic atoms, pion scattering and absorption by nuclei, mesonic corrections to electromagnetic and weak interactions of nuclei, and spin excitations of nucleons and of nuclei. Many of the useful experimental data on these phenomena have come in the last 15 years, through the operation of the "meson factories" at Los Alamos (LAMPF), in Vancouver (TRIUMF), and in Switzerland (SIN, now PSI) and other modern high-intensity accelerators. The theoretical description of these phenomena requires the integration of the physics of elementary particles with that of many-particle systems.

The goal of this book is the presentation of a view of the whole subject through a unified, if somewhat informal, approach to the underlying physical ideas. The book is