implosion work at Los Alamos and the work on elementary particles, interplanetary plasmas and x-ray astronomy at MIT. During the MIT years, when most of this original scientific work was in progress, Bruno carried full teaching responsibilities and found time to write a number of primarily educational books on optics, interactions of high-energy particles, cosmic rays and space physics (with Stan Olbert). Is it possible that Bruno, perhaps joined by Nora, could be convinced to expand the subject matter of some of the chapters in *Moments*?

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Pulsar Astronomy

A. G. Lyne and F. Graham-Smith
Cambridge U. P., New York, 1990. 274 pp. $69.50 hc
ISBN 0-521-32681-8

The discovery of pulsars and the wide range of observations they subsequently made possible will always be regarded as a chapter of outstanding success in astronomy. The pulsars introduced us to a whole new world, which before then was only vaguely suspected by a few theoreticians. That world is one of enormous densities, enormous concentrations of energy and very strong gravity—a world in which Einstein's gravitation is supreme and Newton's laws would not even be a rough approximation. Unlike many other recent discoveries in astronomy, this was one that showed how far into the unknown the theoreticians had successfully penetrated. Of course the pulsars created a number of new puzzles, but what is striking is how much fell into place right away and how many predictions received observational verification.

The book is an excellent account of this chapter of astronomy. The authors have been major contributors to the field—Graham-Smith from the beginning of the investigations, following the announcement of the discovery. The great discovery, the arguments, the numerous considerations that could be brought to bear—all are clearly presented. A physicist, an astronomer or even an interested amateur will have no difficulty following the narrative and appreciating the excitement. The discussion of the astronomical applications and of the suggested mechanisms responsible for the emissions from pulsars will need a little more specialized knowledge.

The emission mechanism is not yet

understood. The authors concentrate their attention on the one suggested mechanism that has so far received detailed mathematical treatment: radiation from the magnetic poles. Some pulsar records suggest such a mechanism, but many others do not. The only alternative mechanism that has been suggested would be the fast-rotating charged-particle-loaded magnetosphere, but the mathematical problems of such a model are so formidable that no significant inroads towards developing it have been made. The only meaningful analysis would be a fully self-consistent calculation of the electromagnetic field; this calculation would have to include the contribution to the field from the magnetospheric particles that travel on the orbits that this field in turn dictates. Neither axial symmetry nor the nonrelativistic simplifications of magnetohydrodynamics would apply. It is a problem far beyond our reach, and the theoreticians cannot be blamed for shunning it. But nature is not guided by mathematical tractability, and many pulsar observations, especially those of polarization, suggest that one has to face up to this situation.

The most beautiful result coming from the entire set of pulsar investigations, and one that is well described in the book, is the detailed verification of the relativity effects seen in a binary pulsar. Joseph Taylor led the work that utilized the enormous accuracy of the pulsar repetition frequency to show that every relativistic effect that could be expected in a binary of two massive, compact objects can be measured to an accuracy of 1% or better, beating by a large margin the accuracies previously obtained for any general relativity effects. Taylor's work includes, for the first time, the determination of gravitational waves: Their emission is found to be in accurate quantitative accord with the predictions of Einstein's theory.

The book represents the most complete overview of the pulsar field yet published, and the close acquaintance the authors have with the field has enabled them to give a very lucid and readable account.

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Quantics: Rudiments of Quantum Physics

Jean-Marc Lévy-Leblond and Françoise Balibar (Translated from the French by S. Twareque Ali)
North Holland, New York, 1990. 539 pp. $44.95 pb
ISBN 0-444-88120-4

When a spin-up neutron diffracts from a crystal of ^{56}Fe, whose nuclei have zero spin, the differential cross section shows strong diffraction peaks. If the same neutron diffracts from a crystal of ^{59}Co, whose nuclei have spin-1/2, the diffraction peaks ride above a continuous background. In this latter case, a spin-flipped nucleus records that the neutron scattered from it alone; the scattering intensities rather than the amplitudes from the other unflipped nuclei add. This quantum mechanical idea and the experiment that supports it require little mathematics for their description. Waves scatter; waves interfere. Amplitudes add coherently; probabilities add incoherently.

This new introductory quantum mechanics textbook—written by Jean-Marc Lévy-Leblond, a theoreti-