The volume concludes with a number of offbeat philosophical discussions between Ulam and Rota on the nature of mathematics, skillfully transcribed from tape recordings.

In the end it does not much matter why Ulam shied away from technical mathematics; what matters is that we see him as he was, a very human hero who succeeded in turning a weakness into major strength. Rota's scientific and psychological portrait in the introduction, suffused with love, pain, understanding and admiration, succeeds in bringing Ulam to life.

The book originally appeared as a special issue of *Los Alamos Science*. The unusual and unusually beautiful design and artwork, including three portraits of Ulam by Jeff Segler, enhance its value and the pleasure it gives; the editor, Necia Grant Cooper, has earned our gratitude.

Geomagnetism

Edited by J. A. Jacobs
Academic, San Diego, Calif., 1987.

Volume 1. *627 pp.*
$112.00 hc ISBN 0-12-378671-1

Volume 2. *579 pp.*
$112.00 hc ISBN 0-12-378672-X

The field of geomagnetism has seen an enormous explosion in knowledge since Sidney Chapman and Julius Bartels, nearly 50 years ago, summarized what was then known about the terrestial magnetic field and its variations in their classic two-volume treatise *Geomagnetism*. Chapman and Bartels's book was published before any *in situ* measurements of the Earth's ionosphere and magnetosphere had been made. By the 1960s a wealth of information acquired from satellite and rocket-borne detectors had greatly supplemented the inferences made using the purely remote sensing techniques available in the era of Chapman and Bartels. In 1967 there appeared a two-volume set edited by Sadami Matsushita and Wallace Campbell, *Physics of Geomagnetic Phenomena* (Academic, New York), which provided an updated view of the character and origin of the Earth's magnetic field. Since then, experimenters have used planetary probes (for example, Mariner and Voyager) to acquire *in situ* measurements of the magnetic fields and charged-particle environments of the many planets and moons of the solar system. The subject that was once called geomagnetism should now more properly be referred to as planetary magnetism.

These new data have given researchers good cause to reexamine the origin of planetary magnetic fields. This fact coupled with the rapid evolution of models for generation of the planet's main field and for the formation of planetary magnetospheres has made imperative the assembling of an updated summary of knowledge in this field. The two-volume set *Geomagnetism*, edited by John A. Jacobs, attempts just that task.

Jacobs has a long history of involvement in studies of the geomagnetic field. During the early stages of his career, he concentrated on investigating the evolution of the Earth's core and on studying dynamo mechanisms to explain the origin of the main magnetic field. He has spent the most recent portion of his career concentrating on these issues as well, but from 1958 to 1968 he was a major contributor to studies of fluctuations in the terrestrial magnetic field (particulary those dealing with the origin of geomagnetic pulsations). Jacobs's background in both space physics and solid-Earth physics gives him a unique perspective from which to mold the content of a modern summary of the origin of magnetic fields in the solar system.

This new set of volumes is particularly strong in two areas. The physics of the Earth's core and the origin of the geomagnetic field are dealt with in a most comprehensive fashion by a series of chapters by Paul Roberts and David Gubbins in the second volume. This outstanding presentation of the theoretical foundation for dynamo theory sits side by side with a summary by Christopher Russell of the most modern *in situ* observations of planetary and magnetic fields. Russell's chapter introduces the reader to the unexpected properties of the magnetic fields of Mercury and Uranus, which pose a challenge to theorists interested in the origin of solar system magnetic fields.

A third volume covering the state of knowledge of short-term fluctuations in the geomagnetic field is in preparation. Since this area of research occupied a good half of the earlier treatises by Chapman and Bartels and by Matsushita and Campbell, the eventual publication of the third volume of *Geomagnetism* will obviously help fill an important void in the coverage of planetary magnetic fields. The first two available volumes of the book also do not cover terrestrial paleomagnetism; perhaps a chapter in a later volume will.

Geomagnetism is clearly oriented toward the professional researcher or senior graduate student dealing with problems in solid-Earth and space physics. The reader who wishes to put these volumes on his personal bookshelf will find the cost somewhat intimidating. However, *Geomagnetism* represents an excellent effort to update the field of solar system magnetism; no institutional library should be without these volumes.

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Riemann, Topology and Physics

Michael Monastyrsky
Birkhäuser, Boston, 1987.
158 pp. $39.50 hc
ISBN 0-8176-3262-X

Felix Klein and Sophus Lie: Evolution of the Idea of Symmetry in the Nineteenth Century

Isaak Moiseevich Yaglom
Birkhäuser, Boston, 1988.
237 pp. $40.00 hc
ISBN 0-8176-3316-2

It is at first sight odd to find combined in one book two essays centered upon such seemingly disparate subjects: a scientific biography of Georg F. B. Riemann, and a short overview of qualitative topological methods in condensed matter physics and field theory. But this impression vanishes quickly in *Riemann, Topology and Physics* when one realizes that standing constantly in the background of this concise and lucid account of the interaction between topology and physics is the figure of Riemann, the generator of many of the ideas that shaped modern mathematics.

The contributions of Riemann to mathematics and physics are as profound as they are varied: the formulation of Riemannian geometry (which provides the basic language of general relativity), the theory of Abelian functions and Riemann surfaces, the determination of the asymptotic distribution of prime numbers, the first ideas on index theory and the relation between analysis and topology, the theory of differential equations, and more in this vein.

In the first part of the book, Michael Monastyrsky gives a terse and beautiful account of some of the questions and insights that motivated Riemann's work. His relation with other notable mathematicians of the 19th century like Richard Dedekind, Peter Gustav Lejeune Dirichlet, Ferdinand