



AIP State Department Science Fellowship 2006 - 2007

The American Institute of Physics and the U.S. Department of State are now accepting applications for the 2006-2007 Fellowship term, commencing in the fall of 2006. If you are a scientist with an interest in foreign policy, this program offers an opportunity to spend a year using your technical expertise to directly support the foreign policy work of the U.S. Department of State.

QUALIFICATIONS include: PhD or equivalent in physics or related field; interest or experience in S&T aspects of foreign policy; membership in one or more AIP Member Societies; and U.S. citizenship. The Fellowship is contingent upon receipt of a security clearance.

A **STIPEND** of \$55,000 and other benefits are provided by AIP.

APPLICATIONS should consist of a letter of intent, a 2-page resume, and three letters of reference. Your letter should discuss your interest in and suitability for the position. Letters of Reference should be mailed directly to the address below.

FOR FURTHER INFORMATION on the program and detailed instructions on applying, please see our website at: <http://www.aip.org/gov/sdf.html>.

ALL APPLICATION MATERIALS MUST BE POSTMARKED BY NOVEMBER 1, 2005 and sent to:

AIP State Department Science Fellowship
American Institute of Physics
One Physics Ellipse
College Park, MD 20740-3843
ATTN: Audrey T. Leath

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powerful Igor Kurchatov, the scientific head of the Soviet nuclear project, had written a reference letter (also included in the book) for Zeldovich? Again, the book reveals no clues.

I regret that the title of the original 1993 Russian edition, which translates into *Familiar Unfamiliar Zeldovich*, was replaced by a less colorful English one. While Zeldovich's science is a great joy for readers to familiarize themselves with, his social personality is still mysteriously unfamiliar.

Fundamentals of Seismic Wave Propagation

Chris Chapman
Cambridge U. Press, New York,
2004. \$75.00 (608 pp.). ISBN 0-
521-81538-X

The universe of seismic wave propagation is divided into overlapping worlds. Scientists who approach the problem from the low-frequency (30 seconds to an hour) global-Earth perspective naturally adopt a formalism based on normal-mode theory in a spherical Earth. Their formalism is well suited for studying part of the wave field containing surface waves and, more generally, long-period waveforms. For those interested in studying the propagation of high-frequency (10 seconds to several tens of hertz) elastic-body waves, a more suitable framework is ray theory, which allows for natural geometrical definitions of seismic phases and expedient computations of their travel times, in realistic media, in Cartesian (flat-layer) or spherical geometry.

Although nearly all introductory seismology textbooks and even most advanced ones aim to describe the entire observed wave field, and therefore cover the basics of both worlds, they do so at the expense of in-depth, consistent, and comprehensive presentation of the state of the art in either approach. In recent years, researchers have made significant advances in the development of numerical methods that are becoming a powerful tool for accurately reproducing observed seismograms in a complex, three-dimensional Earth. However, the methods remain computationally intensive, and seismologists will need to continue to use approximate methods that provide not only faster results but also insights into wave-propagation physics.

Fundamentals of Seismic Wave Propagation by Chris Chapman covers the mathematical development of asymptotic ray theory for seismic waves. It focuses on the specific case of Cartesian geometry as related to local and regional wave propagation on Earth and particularly for situations relevant to the petroleum industry. The author invokes only briefly Earth's flattening approximation as a means to convert from one reference system to the other. But to show the broader applications of the developments presented, the only realistic example that Chapman illustrates—no doubt intentionally—concerns core phases, a global problem that requires spherical geometry.

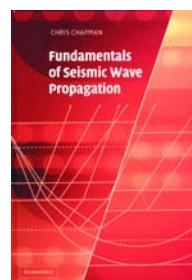
Chapman's book represents a synthesis of his life's work in theoretical ray seismology and attempts to present, in a consistent mathematical fashion, the status of a field to which he has made many original contributions. In this elegant framework, the author successively builds the fundamentals of asymptotic, kinematic, and dynamic ray theory; boundary conditions and their consequences at medium reflection and transmission interfaces; and the response of stratified media in the frequency and wavenumber domain. He also presents several methods—ranging from the classical Cagniard-de Hoop and

the WKBJ (named after physicists Gregor Wentzel, Henrik Kramers, Marcel Louis Brillouin, and geophysicist Harold Jeffreys) techniques to more practical spectral approaches—to recover the wave field in the time domain.

The mathematical developments in the text are first presented in the simplest

case, usually that of acoustic media, and are then repeated for the general case of anisotropic elastic media and the particular case of isotropic media. This progression allows readers to first grasp the principles before gradually building more sophistication.

The first four chapters can be studied independently from the book's core material as they provide a good reference to the seismologist's basic theoretical tool kit. Chapters 2, 3, and 4 include a simple and clear layout of the basic ray-related concepts, a discussion of the mathematical tools used—principally transforms—and a review of continuum mechanics and elastic waves. Although the material presented in the bulk of the book concerns the simple situation of stratified media, chapter 10 is devoted to tech-



niques that allow the extension of ray theory beyond its theoretical limits: the Maslov approach, Born scattering theory, and the Kirchhoff surface-integral method—each of which helps solve a different shortcoming of ray theory. An appendix provides additional useful mathematical background.

Chapman's book is most suitable for a graduate theoretical course in high-frequency seismology and could be compared with *Quantitative Seismology: Theory and Methods* (W. H. Freeman, 1980) by Keiiti Aki and Paul Richards. Chapman's text may serve a similar role for high-frequency seismology as *Theoretical Global Seismology* (Princeton U. Press, 1998) by Francis A. Dahlen and Jeroen Tromp does for normal-mode theory. Both texts expand beyond the already sophisticated basics of the field as presented in Aki and Richards's book.

Fundamentals of Seismic Wave Propagation covers more or less the same ray-theory material found in Brian L. N. Kennett's two-volume *The Seismic Wavefield* (Cambridge U. Press, 2001 and 2002). Yet Chapman stresses more the mathematical elegance of seismic wave propagation and places little emphasis on actual

observations. Nonetheless, mathematicians and mechanicians will certainly appreciate the author's elegant presentation of the field.

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Rubber and Rubber Balloons: Paradigms of Thermodynamics

I. Müller and P. Strehlow
Springer-Verlag, New York, 2004.
\$59.95 (123 pp.). ISBN 3-540-20244-7

Books on physics are rarely amusing—which is probably a bad thing. Perhaps if the work of physicists revealed more of the thoughtful irreverence that many display in person, the discipline would not be quite so dry and imposing to the general public. So I mean it as praise when I say that the small volume *Rubber and Rubber Balloons: Paradigms of Thermodynamics* by Ingo Müller and Peter Strehlow is amusing. To get a sense of the authors' playful spirit, one has only to turn to the end of chapter 8, where a photo-

graph of 20 balloons dangling off the sides of a Lucite tube looks like a bid for installation at New York City's Museum of Modern Art. At the same time, the book's serious subtitle signals the authors' intention of using a whimsical topic to illustrate deep and general physical principles.

Rubber and Rubber Balloons is not only amusing, it also has a narrative. It begins with a very simple account of the physics involved in blowing up a balloon; a set of puzzles having to do with the way the pressure changes as the balloon expands is then posed. While reading through the chapters, one travels with the authors as they are tripped up by inconsistencies in the literature and false interpretations of data. They eventually resolve an old problem that concerns a symmetry-breaking state of rubber. The

physical point in question is unfortunately not especially significant in itself; yet the account, complete with cliffhanger at the end of chapter 3, is engaging.

The technical level of the book, however, oscillates wildly. Chapters 1, 8, and 10 have almost no equations and are practically suitable for high-school students.

