

BOOK REVIEWS

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Physics of Societal Issues: Calculations on National Security, Environment, and Energy. David Hafemeister. 487 pp. Springer, New York, 2007. Price: \$149.00 (hardcover) ISBN 978-0-387-95560-5. (Philip L. Taylor, Reviewer.)

If there is one characteristic that distinguishes us, as physicists, from the rest of humanity, it is the supreme confidence we have that we can make order-of-magnitude estimates. All we need is the back of an envelope or a cocktail napkin.

For example, we might consider Earth in its early days, when it was a molten sphere, and wonder what the period τ would be of oscillations between oblate and prolate shapes. We immediately note that the period could only depend on Earth's density ρ , its radius r , and the gravitational constant G . Dimensional analysis then reveals the remarkable result that τ^2 must be of order $1/\rho G$, and not depend on r at all. If we cannot remember the numerical value of G , then we work in terms of the more familiar g , the acceleration due to gravity at Earth's surface, and find that $\tau^2 \sim r/g$, making τ of the order of half an hour. It's all so easy!

One thus can imagine the frustration felt by David Hafemeister when he first went to Washington to work as a congressional fellow, and was confronted with the task of providing scientific advice on the feasibility of missile defense systems, environmental measures, or oil reserve estimates. He had his pencil, his envelope, and his training, but no resource from which to pluck the numbers he needed for his calculations. What was the angular error inherent in the aiming of a ballistic missile? What was the limit of infrared detection in space?

This book is Hafemeister's attempt to fill the need that he felt for a work that would guide the physics-savvy reader through the myriad problems that arise when one wants to make estimates of the quantities that lie at the heart of national security and environmental issues. It provides the data one needs to calculate everything from a missile's kill radius to the aerodynamic drag on an automobile, and then leads the reader through the simple calculations that these figures make possible. Of the three sections of the book, I found the one on national security issues to be the most valuable, as there are fewer other sources on this topic than there are on environmental and energy questions. The chapters on nuclear

weapons, missiles, and missile defense are followed by a chapter on arms control treaties and verification, and one on nuclear proliferation. One wishes that this material had been available in the era when serious political discussion of these issues was more in vogue than it is today. The sections on the environment and energy are admirably complete, and include, for instance, a balanced discussion of the biological effects of electromagnetic fields.

Overall, Hafemeister has done a great service in providing us with the results of his lifetime of assembling data, and in showing us how it can be used to guide policy. As one might expect for the fruits of a long-term project, some of his information is now spectacularly outdated, especially in the section on energy. We are told that oil from tar sands is not competitive (Canadian production is now well over a million barrels per day), and that U.S. wind power is projected to grow by 6% per year (it grew by 45% in 2007). Some good copyediting would have removed references to "Earnest Shackleton," "Lake Agasswiz," and "break shoes."

How will this book be used? I will keep it on hand as a reference source, and as a book to dip into from time to time. The author has included hundreds of exercise problems, some easy and some very difficult, at the ends of the chapters, and so it could form the text for a course at various levels. In this context it must be compared with a legion of other books, the most notable of which are the 1988 text *Consider a Spherical Cow: A Course in Environmental Problem Solving*, by John Harte; *Back-of-the-Envelope Physics*, by Clifford Swartz (2003); or the more recent *Guesstimation: Solving the World's Problems on the Back of a Cocktail Napkin*, by Lawrence Weinstein and John A. Adam (reviewed in the September 2008 issue of *AJP*). While David Hafemeister's new book compares well with the others in its treatment of energy and environmental issues, it is in its coverage of national security questions that it is unique. It will be an invaluable resource in courses that include a quantitative study of defense issues.

Philip L. Taylor is the Perkins Professor of Physics at Case Western Reserve University, where he teaches courses on Energy and Society.

BOOKS RECEIVED

Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb.

David C. Cassidy. 480 pp. Bellevue Literary Press, New York, 2009. Price: \$27.00 ISBN 1-934137-13-0.

Biomimetic Robotics: Mechanisms and Control. Ranjan Vepa. 359 pp.

Cambridge U. P., New York, 2009. Price: \$ 99.00 (hardback) ISBN 978-0-521-89594-1.

Bose-Condensed Gases at Finite Temperatures. Allan Griffin, Tetsuro Ni-

kuni and Eugene Zaremba. 473 pp. Cambridge U. P., New York, 2009. Price: \$130.00 (hardback) ISBN 978-0-521-83702-6.

Foundations of Astrophysics. Barbara Ryden and Bradley M. Peterson.

608 pp. Pearson Addison-Wesley, San Francisco, CA, 2010. Price: \$133.33 (hardback) ISBN 978-0-321-59558-4.

Geological Fluid Dynamics: Sub-surface Flow and Reactions. O. M.

Phillips. 296 pp. Cambridge U. P., New York, 2009. Price: \$ 80.00 (hardback) ISBN 978-0-521-86555-5.

Heisenberg and the Interpretation of Quantum Mechanics: The Physi-

scient as Philosopher. Kristian Camilleri. 211 pp. Cambridge U. P., New York, 2009. Price: \$ 90.00 (hardback) ISBN 978-0-521-88484-6.

How to Think Like a Mathematician: A Companion to Undergraduate Mathematics. 276 pp. Cambridge U. P., New York, 2009. Price: \$ 34.99 (paper) ISBN 978-0-521-71978-0.

The Periodic Table: Its Story and Its Significance. Eric R. Scerri. 369pp. Oxford U. P., New York, 2007. Price: \$ 35.00 (hardback) ISBN 978-0-19-530573-9.

Polymers, Liquids and Colloids in Electric Fields: Interfacial Instabilities, Orientation and Phase Transitions. Yaov Tsori and Ullrich

Steiner (eds.) 293 pp. World Scientific Hackensack, NJ, 2009. Price: \$ 78.00 (hardback) ISBN 978-981-4271-68-4.

A Student's Guide to Maxwell's Equations. Daniel Fleisch. 143 pp. Cambridge U. P., New York, 2008. Price: \$28.99 (paper) ISBN 978-0-521-70147-1.

The Uncertainty in Physical Measurements: An Introduction to Data Analysis in the Physics Laboratory. Paolo Fornasini. 302 pp. Springer, New York, 2008. Price: \$ 89.95. ISBN 978-0-387-78649-0.

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