

ture did scientists regain political influence. Her account is nonsense. Franklin is a false starting point, and the history of European politics during the 19th century is strewn with men of letters and science.

As a historian, I do not find it gratifying to admit to readers of *PHYSICS TODAY* that my colleague's attempt to make sense of their science has fallen so short. Two more of Chaplin's blurbists, Dudley Herschbach, a Nobel laureate in chemistry, and Lawrence Krauss, a distinguished physicist, judge *The First Scientific American* to be admirable in concept and execution. The book is full of "verve, insight and wit," according to Herschbach, and, according to Krauss, offers, a "fascinating . . . comprehensive exploration of [Franklin's] scientific side." Herschbach and Krauss's uninformed tolerance is misplaced. The cracks between the cultures of science and history should not be safe havens for work that would not survive in either.

Comets

Nature, Dynamics, Origin, and Their Cosmogonical Relevance

Julio Angel Fernández
Springer, Dordrecht, the Netherlands,
2005. \$159.00 (383 pp.).
ISBN 1-4020-3490-3

The study of comets is currently in a remarkable period. Progress is often stimulated by the appearance of bright comets such as Hyakutake in 1996 and Hale-Bopp in 1997, or by a space mission to examine comets. The *Stardust* mission encountered comet Wild 2 on 2 January 2004 and returned samples of cometary dust for laboratory analysis. On 4 July 2005 the *Deep Impact* mission to comet Tempel 1 performed the first experiment on a comet by delivering 19 gigajoules of kinetic energy to the surface of the comet's nucleus and recording the effects.

Against this backdrop of recent comet research, Julio A. Fernández's *Comets: Nature, Dynamics, Origin, and Their Cosmogonical Relevance* treats extensively a part of cometary physics that is not closely linked to single events but instead is based on Newtonian mechanics. Research based on Newtonian mechanics is not always considered at

the cutting edge of science—but it certainly is for studies of asteroids and comets in the solar system. Understanding their long-term orbital histories requires approaches and techniques far beyond simple Keplerian orbits. Fernández, a professor of astronomy at the University of the Republic in Uruguay, is a leading authority in the field and has presented an excellent account up to January 2005. The text has references to published material through 2004 and to some papers in press in 2005.

One serious quibble concerns the title of the book versus the goals stated in the preface and the actual content. Despite what the subtitle suggests, the book contains about four times more discussion on dynamics than on nature. As a result, the text is not a suitable introduction to comets. For comprehensive coverage at the research level, readers can consult *Comets II* (U. Arizona Press, 2004), edited by Michel C. Festou, H. Uwe Keller, and Harold A. Weaver; at the tutorial level they can look at the second edition of *Introduction to Comets* (Cambridge U. Press, 2004), which I coauthored with Robert D. Chapman.

Nevertheless, Fernández's monograph is a lucid account of cometary dynamics and related topics that is an important contribution to the literature. His style combines a readable narrative with order-of-magnitude estimates and detailed mathematics where necessary. Among the topics discussed are the dynamics of long-period comets and the Oort cloud. The author explains how encounters with passing stars and giant molecular clouds, as well as galactic tides, influence comets in the Oort cloud and send some of them into the inner solar system. But getting into the inner region is not simple because Jupiter and Saturn act as gravitational barriers. In fact, the fate of most comets is ejection from the solar system. Advances in the understanding of orbits and dynamics have influenced the descriptions of them. Although such terms as short period and long period are still used, researchers also speak of "Jupiter-family" and "Halley-type" comets.

The need to pin down the source of the Jupiter-family comets naturally leads to a discussion of the belt of trans-Neptunian, icy objects. Fernández gives a nice, brief history of the confusion over the name of that belt—whether it should be called the Kuiper belt or the Edgeworth-Kuiper belt. The structure and evolution of the trans-Neptunian belt is fascinating. Many objects, called

plutinos, and including Pluto, are in a stable mean-motion resonance with Neptune. The scattering of the icy planetesimals or cometesimals in the early solar system is responsible for the major outward migration of Neptune's orbit.

The formation of comets is a topic closely related to the formation of the solar system. The dynamics presented in the book take comets from their formation to their end states. The author also covers the dynamical issues related to the hypothesis that comets supplied Earth with water and the seeds of life. The need for an external source seems clear, but the relative contributions from comets and asteroids remain to be determined. Fernández's brief closing discussion of comet missions is somewhat out of date, a problem common to all recent comet treatises.

Comets provides an important and extremely readable summary of cometary dynamics and related topics. It is accessible to anyone with a basic knowledge of celestial mechanics and astronomy. Many scientists, including astronomers, can benefit from reading it. And despite the book's high price, they should buy a copy for themselves.

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The Universe in a Single Atom

The Convergence of Science and Spirituality

Dalai Lama
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Last November, amid some controversy, Tenzin Gyatso, Dalai Lama XIV, addressed more than 10 000 scientists at the Society for Neuroscience's annual meeting in Washington, DC. He spoke about recent developments in the "neuroscience of meditation" and the ethical implications of science. The Dalai Lama's talk was the most recent instance of his lifelong interest in science, a story engagingly told in his *The Universe in a Single Atom: The Convergence of Science and Spirituality*.

The Dalai Lama articulates the need for what he terms an "urgent engagement" between Buddhist philosophy

