

APS CONGRESSIONAL SCIENCE FELLOWSHIP 2015-2016

THE AMERICAN PHYSICAL SOCIETY is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

QUALIFICATIONS include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be members of the APS.

TERM OF APPOINTMENT is one year, beginning in September of 2015 with participation in a two week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

A STIPEND is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

APPLICATION should consist of a letter of intent of no more than 2-pages, a 2-page resume: with one additional page for publications, and three letters of reference. Please see the APS website (<http://www.aps.org/policy/fellowships/congressional.cfm>) for detailed information on materials required for applying and other information on the program.

**ALL APPLICATION
MATERIALS MUST BE
SUBMITTED ONLINE BY
CLOSE OF BUSINESS
ON JANUARY 15, 2015
(5:00 PM EST).**

emphasizes improved high-spatial-resolution satellite observations of the ocean and ultrafast and powerful supercomputing as supports and complements to experimental efforts. His several predictions include a new generation of ocean and wave forecast models and better understanding of complex nearshore dynamics and the coupling of microscale-wave-related processes with various air-sea exchanges.

The Science of Ocean Waves is a truly remarkable achievement. It has a great chance to become a standard text for students, scientists, weather and ocean forecasters, engineers, climate modelers, and anyone else whose curiosity or professional interests relate to ocean waves.

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Polarons

David Emin
Cambridge U. Press, 2013. \$110.00
(212 pp.). ISBN 978-0-521-51906-9

The polaron was proposed by Lev Landau in 1933 to describe an electron moving in a dielectric crystal whose atoms displace from equilibrium to screen the electron charge. Large polarons, whose radii are much larger than the lattice constant, are described by a Hamiltonian named after Herbert Fröhlich. Small polarons, whose radii are of the same order of magnitude as or even smaller than the lattice constant, were first studied in the late 1950s by Theodore Holstein, Jiro Yamashita, and Tatumi Kurosawa. Holstein introduced a simple model for short-range electron-phonon interactions that lead to the hopping motion of what would be identified as small polarons.

Polarons come in several varieties, including acoustic polarons, piezopolarons, and polarons in organic materials. Polaron-like states can even be found in Bose-Einstein condensates. Both the large- and small-polaron pictures are used for the interpretation of experiments on optical, thermal, and electromagnetic response in crystals.

With *Polarons*, David Emin aims to present a relatively simple, mostly empirical introduction to the relevant physics. The first section qualitatively describes the formation of several po-

laron states: large and small polarons, molecular polarons, and large and small bipolarons (bound polaron pairs). Its final subsection, on magnetic polarons, gives a nice explanation of colossal magnetoresistance in ferromagnetic semiconductors. The book's second section addresses manifestations of polarons in the physical properties of crystals. The third section treats extensions of the polaron concept, including the presently hypothetical bipolaron superconductivity.

Emin is at his best discussing small-polaron phenomena, a subject to which he has devoted most of his own research, some of it in collaboration with Holstein. But in treating large-polaron physics, the book is sometimes less accurate: In particular, chapter 9 has a flawed description of the theory of large-polaron optical absorption at strong coupling. The book fails to discuss recent optical experiments indicating that Fröhlich polarons—as well as small polarons—can act as charge carriers in strontium titanate. Emin omits some key methods and topics in polaron theory, including Richard Feynman's path-integral variational approach; Sin-itiro Tomonaga's translation-invariant description used by T. D. Lee, Francis Low, and David Pines; Nikolai Bogolyubov's field-theoretic treatment; and the diagrammatic quantum Monte Carlo method refined by Andrei Mishchenko and colleagues. Frederick Brown and coworkers' seminal experiments on Fröhlich polarons are also missing.

Polarons mainly addresses graduate students, but it can also be useful for advanced researchers, particularly experimentalists. I would recommend the book as a qualitative introduction to the physics of small polarons. As such, it nicely complements the existing literature.

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In Search of the True Universe The Tools, Shaping, and Cost of Cosmological Thought

Martin Harwit
Cambridge U. Press, 2013. \$50.00
(393 pp.). ISBN 978-1-107-04406-7

When I was 12, my father told me that one of the best things to do when going to sleep is to rehash the day. "Go over

