

Atoms and Molecules (Benjamin Cummings, 2nd edition, 2003). And the syllabus could be summarized as “one, two, many”: hydrogen first, then helium, followed by multielectron atoms, and rounded off with fine structure and the Zeeman effect.

However, with crowded schedules, and with new and exciting branches of physics demanding their place in the syllabus, such courses nowadays seem to be more the exception and less the rule. Atomic physics, rather than being an end unto itself, is now valued as an essential tool in various subfields. Thus courses aimed at advanced undergraduates or beginning graduate students are concentrating on aspects of atomic physics needed to carry out experiments with ultracold atoms confined in various traps and laser-cooled to unprecedentedly low temperatures. For example, a course may feature the structure of alkali-like atoms and their interactions with lasers and static electromagnetic fields; I have taught such a course to graduate students at the University of Toronto for the past five years.

Modern textbooks suitable for this new approach are few. Perhaps the best introductory work is C. J. Foot’s *Atomic Physics* (Oxford University Press, 2005), which provides a good survey but not the level of detail graduate students need for a quantitative mastery of atomic systems’ intricate physics. Necessary details can be found in more complex monographs, such as Igor Sobelman’s *Atomic Spectra and Radiative Transitions* (Springer, 2nd edition, 1992), but such tomes are not suitable for classroom use.

Optically Polarized Atoms: Understanding Light–Atom Interactions by Marcis Auzinsh, Dmitry Budker, and Simon M. Rochester aims to fill the void. The book is specifically intended for use in a one-semester course in which the symmetry and angular momentum aspects of atomic structure and laser–atom interactions are central. The first half of the book covers the basic material, with an emphasis on applications of the quantum theory of angular momentum. The second half contains 10 reasonably self-contained chapters discussing specific applications: It might be used in a longer course to illustrate the first half’s material. The level of detail and the clarity of explanation are admirable.

I do have a few niggles: The authors’ use of Gaussian units, which most students today do not understand, is an irritating distraction, and the absence of end-of-chapter problems is similarly irksome to instructors, who are forced

to devise their own. Nonetheless, I highly recommend *Optically Polarized Atoms* and will probably use it next time I teach my graduate course.

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Introduction to Nanophotonics

Sergey V. Gaponenko
Cambridge U. Press, New York,
2010. \$78.00 (465 pp.).
ISBN 978-0-521-76375-2

The study of electronic and electromagnetic physics, specifically at the nanoscale, has become as exciting, productive, and fascinating as any other research area with which it competes for funding, graduate students, and audiences. Bulk materials have been studied for decades, but in the past 10 years or so, new fabrication processes and technologies have enabled the production of samples with well-defined, optical-wavelength-range structural properties. Those advances have opened up the field of nanophotonics, the discipline in which nanotechnology and nanoscience generate the photonic conditions necessary for controlled interactions between light and matter.

In *Introduction to Nanophotonics*, Sergey Gaponenko expertly and comprehensively introduces the key concepts, theory, and experiments that reflect the beauty of the photonic nanoworld. Despite the field’s diversity of topics, the book’s presentation is logical, elegant, and delightful: Gaponenko presents as coherent a journey through the fundamental models and components of the subject as one could hope to read in any authoritative introduction to the field. He is well-qualified to do that, having spent a decade at the Institute of Molecular and Atomic Physics in Minsk, Belarus, where he generated an impressive list of nanophotonics-associated publications.

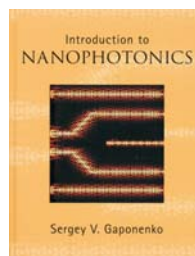
Good scientists do not always make lucid and able writers. Gaponenko, however, demonstrates an effective style that engenders interest and provides genuine scientific clarity. Aimed at undergraduate and graduate students of physics, optical and electronic engineering, and materials science, the book also achieves a nearly perfect tone and pace, particularly in its discussions of historical scientific perspective and the development of key concepts and

scientific theory. I think it will also be useful to researchers from other fields who are unfamiliar with the specific language and central theories of nanophotonics.

In part 1, “Electrons and Electromagnetic Waves in Nanostructures,” the author develops and then compares and contrasts wave-optics theory in periodically nanostructured systems and complex media to electron-wave mechanics in analogous systems. Though that is not an uncommon approach, Gaponenko’s detailed discussions here are, in my experience, unsurpassed. In part 2, “Light–Matter Interaction in Nanostructures,” the author develops some of the topic’s more specialized aspects. Particularly well presented is the final chapter describing plasmon-based light-scattering enhancement methods.

Although I do not hesitate to praise the many excellent aspects of *Introduction to Nanophotonics*, I do have two reservations about it. First, in terms of content, biological photonics, a major focus of one of my own research areas, is extraordinarily underrepresented—comprising less than a single page of text and three electron microscope images of mediocre quality. Second, the book’s black-and-white format with grayscale figures creates a rather unexceptional visual impact—I suspect that because they are rendered in black and white, many figures have lost some pedagogical clarity. By contrast, the clarity added by the full-color images and graphs of a comparable first-rate text, *Photonic Crystals: Molding the Flow of Light* (Princeton University Press, 2nd edition, 2008) by John Joannopoulos, Steven G. Johnson, Robert Meade, and Joshua Winn, is certainly one reason that book is on virtually every photonics student’s bookshelf. Professional researchers might believe that content outweighs appearance many times over, but students consider, and would benefit from, quality content and appearance. Cambridge University Press has missed the opportunity to make Gaponenko’s book unrivalled as a reference text in nanophotonics, not only in content and scope (which the author has managed himself), but also in visual impact and figure clarity.

In the introduction, the author describes his hope that college seniors will be successfully introduced to “the amazing world of nanophotonics” by going through his book. I am inclined to believe *Introduction to Nanophotonics*



will do just that. I will certainly recommend it for the bookshelves of each of my students.

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Nucleus and Nation

Scientists, International Networks, and Power in India

Robert S. Anderson
U. Chicago Press, Chicago, 2010.
\$60.00 (683 pp.).
ISBN 978-0-226-01975-8

I was a young physics student in India when the country conducted its first nuclear test on 18 May 1974 in the desert in Rajasthan. It took the world by surprise, not least because many found it inconceivable that the feat was achieved by a country beset with poverty and a lack of adequate industrial and technical infrastructure. For Indians, that "peaceful nuclear device" was a source of national pride and a matter of international prestige. But the test resulted in several nations placing severe sanctions on India, including a

ban on technical equipment being shipped into the country. That ban adversely affected India's research effort for nearly two decades. Indian laboratories and universities could not even import medium-sized computers or advanced oscilloscopes from the US during much of that period.

The test also led to the formation of the Nuclear Suppliers Group, a cartel of nuclear supplier countries that, according to its website, "seeks to contribute to the non-proliferation of nuclear weapons." India's nuclear weapons tests in May 1998 cemented its status as a world nuclear power; since then, subsequent agreements have been struck with the US and the suppliers group for civilian nuclear trade. India is now accepted as a de facto nuclear weapons state, even though it is not yet party to the Treaty on the Non-Proliferation of Nuclear Weapons.

In *Nucleus and Nation: Scientists, International Networks, and Power in India*, Robert Anderson traces the history, starting in the 1920s, of the country's scientific research and institutions. He highlights what he believes are the



efforts that formed the basis of India's developments in nuclear power and space technology. He tells the stories of three Indian scientists—two physicists and one chemist—who formed the "nucleus" (referred to in the book's cleverly punning title) that was instrumental in creating the scientific infrastructure that

enabled the nuclear tests. Physicists Meghnad Saha and Homi Bhabha and chemist Shanti Swaroop Bhatnagar were not only first-rate scientists but also visionary leaders and founders of institutions that have since flourished. Indeed, some of India's top scientists passed through those institutions, including my colleague Samir Bose, who worked as a young theoretical physicist in the 1960s at the Bhabha-founded Tata Institute of Fundamental Research.

Nucleus and Nation is a long book—nearly 600 pages of text, plus another 100 pages of notes. It is based primarily on material the author collected during an extended stay in India in the late 1960s while completing his dissertation, an anthropological study of the culture of the country's science and scientific

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