

the penultimate chapter, and the reader won't learn about kilowatt-hours, the unit of energy most homeowners actually buy every month, until the final chapter. Insull falls from grace in chapter 3, but we don't learn what happens to him until the end of chapter 4. Florid musings on the downside of technology are liberally dropped throughout the text graced with selected quotes from Henry Adams and Henry David Thoreau. Conservation is important, especially in the midst of global warming, but the book would be stronger if that topic were left to the end rather than inserted here and there.

Schewe's baroque flourishes, Walden-esque contemplation, and nonlinear organization suggest that he doubts that readers share his fascination, and mine, with electricity. The assumption is understandable. When I tell acquaintances that I work on electricity economics, "boredom squared" is in their eyes. And I bet when Schewe told fellow dinner-party guests that he was working on a book on electricity, it probably took milliseconds for someone to interrupt with "Anyone seen a good movie lately?" Much of *The Grid* might offer promising material for Hollywood producers. I hope Schewe, also a dramatist, is working on screenplays for the 1965 New York City blackout miniseries and the Insull biopic. Those stories would be worth seeing.

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Iridescences

The Physical Colors of Insects

Serge Berthier
(translated from French
by Capucine Lafait)

Springer, New York, 2007. \$139.00
(160 pp.). ISBN 978-0-387-34119-4

Serge Berthier's *Iridescences: The Physical Colors of Insects* is purported to be a "new, improved, and substantially modified version" of his *Les couleurs des papillons ou l'impérative beauté: Propriétés optiques des ailes de papillons*, or *The Colors of Butterflies or Imperative Beauty: Optical Properties of the Wings of Butterflies* (Springer, 2000). Berthier is a professor of physics at the University of Paris Diderot-7 and researches biological structures, colors, and biomimetics at Pierre and Marie Curie University. The one positive aspect of *Iridescences*, originally published in French in 2003, is that it does have wonderful color photographs that show some amazing detail of the structure and morphology

of the orders Coleoptera, which includes beetles, weevils, and fireflies, and Lepidoptera, which includes butterflies and moths.

Berthier's book could have been a very nice piece of work if it had been proofread to correct the plethora of errors in grammar, history, and references to figures. For example, on page 3 in the first chapter, the author refers to "Lord Raleigh"—yes, with the last name misspelled the same way each time the physicist is mentioned—as fourth baron, who was at Imperial College London, which is correct. However, when most physicists see the name "Lord Rayleigh," they think of the more famous Rayleigh, John William Strutt, who was third baron and taught at Cambridge University. Berthier is actually referring to Robert J. Strutt, Lord Rayleigh's eldest son who inherited the title after his father died in 1919.

In chapter 2, Berthier takes readers through plausible arguments about the myriad of color variations found in insects, and in chapters 3 and 4 he focuses on the different characteristic lengths of scales of insect wings in both Coleoptera and Lepidoptera. He then discusses in chapter 5 how pigmentation and structure are responsible for most color variation. He introduces equation 5-1, which shows how to get an interference reflection minimum from a thin layer, yet there is no figure or explanation as to where the equation comes from; unless the reader is already familiar with thin-film interference theory, the equation will mean nothing.

Another repeated annoyance is that the descriptions and labels of figures are written in a mixture of French and English. The labels in figure 11.3 are entirely written in French while the figure caption is written in English. In chapter 13, the author introduces the trichromatic coordinates R , G , B but then in equation 13-3 uses normalized r , v , b coordinates. One has to assume that the v stands for "vert," the French word for "green." In addition, many of the figures are poorly done. For instance, figure 6.3, which shows the Fresnel reflection coefficient, has no scale for the ordinate. It should also be noted that the Fresnel formulas are not presented until chapter 7. Also, in chapter 6, the author introduces the Kramers-Kronig relations, equation 6-7, that are incorrect as presented.

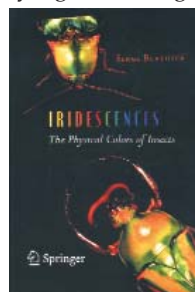
In chapter 7, "1-Dimensional Structures: Interferences," Berthier attributes the laws of reflection and refraction to both Willebrord Snel van Royen

and René Descartes. However, back in figure 6.2 the law of refraction is called Descartes' law, and on page 90 in chapter 8, "2-Dimensional Structures: Interferences and Diffraction," Berthier refers to it as "Snell's law." But the law of refraction was actually first discovered by Thomas Harriot in 1602, though that was not known until 1959. Chapter 9, "3-Dimensional Structures: Crystalline Diffraction," deals with periodicity in three dimensions. Berthier introduces the Bragg relation, equation 9-1, as $2d \sin \theta = k\lambda$, in which he uses k to represent an integer, another hassle because we are used to seeing k as the wave number. In the sentence above the equation, he refers to Φ as the angle to be used in the equation, which contains θ , not Φ . That equation and the accompanying figure 9.1 give no clue as to why constructive interference occurs. The author then goes on to introduce a two-dimensional Fourier transform in equation 9-2, again with no explanation.

In Chapter 10, "Amorphous Structures: Scattering," Berthier discusses the concept of larger-size particle scattering within the framework developed by Gustav Mie in 1908. The author later gives credit for the first development to Ludwig Lorenz; however, although Lorenz developed the theory in 1890, he only published his research in Danish. Most people today give credit to both men and refer to the Lorenz-Mie theory. Berthier then ties the theory to the scattering structures found in certain butterflies, which allows readers to understand the insects' color variation. Chapter 11 treats selective absorption and some of the chemistry necessary to explain it.

I found chapter 12, on thermoregulation and spectral selectivity in butterflies, quite informative; it explained how essential heat transfer is to the survival of those marvelous insects. In the final chapter, 13, "Vision and Colorimetry," the author uses trichromatic coordinates to explain insect vision. He briefly discusses the perception of polarized light by insects but does not mention the enormous amount of work already published on the subject.

In short, if you are looking for a book that offers some understanding of the relationship between the basic laws of physics and the coloring of insects, *Iridescences* leaves much to be desired. On the other hand, if you want to see some wonderful photographs that show the intricate and delicate struc-



tures of insect wings, then Berthier's book fits the bill.

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Practicing Science, Living Faith

Interviews with 12 Leading Scientists

**Edited by Philip Clayton
and Jim Schaal**
Columbia U. Press, New York, 2007.
\$29.50 (250 pp.).
ISBN 978-0-231-13576-4

Quantum Physics and Theology

An Unexpected Kinship

John Polkinghorne
Yale U. Press, New Haven, CT, 2007.
\$26.00 (112 pp.).
ISBN 978-0-300-12115-5

The relationship between science and religion is the subject of ongoing discussion, and sometimes contentious debate. *Practicing Science, Living Faith:*

Interviews with 12 Leading Scientists, edited by Philip Clayton and Jim Schaal, and *Quantum Physics and Theology: An Unexpected Kinship*, by John Polkinghorne, contribute to the discussion from two somewhat different perspectives.

Each chapter of *Practicing Science, Living Faith* begins with a short biographical sketch of each scientist that includes, among other things, professional specialty, geographical location, and internationally recognized scientific achievements. That information is followed by the interview. The original oral narrative has been edited with the goal of preserving as much as possible the scientist's personality and style. The editors' difficult task has been carried out quite well, though occasionally what an interviewee is trying to say remains a bit obscure.

A significant part of each interview is a discussion, in nontechnical terms, of the researcher's work. I always found that part interesting. It is followed by questions about the scientist's religion or spiritual and moral values and how those values relate to his or her work. In some cases the responses are quite compelling, but in others, they are somewhat bland. Although the interviews vary a lot in length and in overall qual-

ity, the reader always catches some glimpse of the scientist as a human being involved in much more than just technical issues. The scientists come from a variety of fields, from astrophysics to zoology, with a strong representation from the biological sciences. Psychology and linguistics are included, while the other social sciences are not. There are an equal number of men and women, with most from Europe and North America; however, scientists from Africa and Indonesia are also interviewed.

The religions represented in the book include Baha'i, Buddhism, Christianity of different sorts, Islam, and Judaism. Scientists with no formal religion are also represented. Given the broad diversity, do any common themes emerge in the text? In the concluding chapter, Clayton asserts that each scientist is involved in serious reflection on matters of science and faith, the latter understood in a very broad sense; and despite occasional conflicts, each has succeeded in integrating the two. As a consequence, the interviews serve to undercut a widely held stereotype that science demands complete neutrality and objectivity, which can be achieved only by people with no

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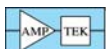


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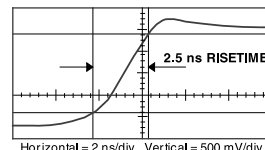
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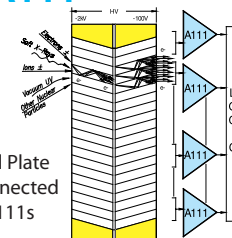
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