

chapters, “Dusty Plasmas” and “Plasma Generation,” are comprehensive; they distinguish Piel’s text from others and stand out since the author has particular expertise on those topics. The treatment of dusty plasmas is thorough and modern with careful descriptions of experimental apparatus and detailed discussions of data.

I have only a few criticisms. First, although the book has several interesting photographs from solar and astrophysical plasmas and from low-temperature and laboratory plasmas, none of the images are in color. Also, readers and lecturers will have to turn elsewhere for a more formal mathematical treatment and a greater variety of end-of-chapter problems. Still, with an extensive list of more than 300 references and, in particular, its excellent overview of the various techniques to generate plasma in a laboratory, *Plasma Physics* is an excellent entrée for students into this rapidly growing field. It’s also a useful reference for professional low-temperature plasma researchers.

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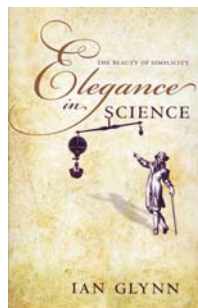
Elegance in Science

The Beauty of Simplicity

Ian Glynn
Oxford U. Press, New York, 2010.
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As a graduate student of John Wheeler at the University of Texas at Austin, I remember overhearing a conversation between his office assistant and Steven Weinberg’s assistant. They were puzzled at what passed for elegance in the eyes of physicists. Apparently, typing up manuscripts on general relativity and quantum field theory left them incredulous that physics could be elegant!

Engaging in sophisticated debate about the nature of elegance and its relationship to truth isn’t the intent of *Elegance in Science: The Beauty of Simplicity*. Instead, author Ian Glynn, professor emeritus of physiology at the University of Cambridge, aims at a broad audience and presents examples of scientific inquiries that illustrate elegance in action—though often the elegance is left unstated. Many of those examples can be useful in a variety of physics classes at the high-school and under-



graduate levels. The case studies of experiments establishing energy conservation (chapter 5) and light waves (chapter 6) show the ingenuity and care that goes into good experimental work and can serve as supplementary materials in introductory physics classes. Students in an upper-division thermodynamics course can quantitatively analyze the experiments in chapter 5 to determine why they convincingly demonstrate energy equivalence and conservation. In chapter 7, the experiments establishing action potentials and the flow of electrical current through nerves are interesting examples for students to explore in courses on electrical circuits.

Although the book’s historical discussions are generally good, Glynn makes some unfortunate gaffes. For instance, he claims Ptolemy “introduced several ingenious fudges” into his geocentric model of the universe (page 19). In fact, the epicycle and the eccentric were originally applied prior to the first century by Apollonius of Perga, whose astronomical models were based on the system of Aristotelian natural philosophy. Only Ptolemy’s unique mathematical construction, the equant, was a fudge, since it violated the long-standing—and elegant!—idea that all heavenly bodies moved in perfect uniform motion.

Glynn goes on to claim that Johannes Kepler, while drawing geometric diagrams for his class, “suddenly realized” (page 22) that the five Platonic solids can be arranged so that each is circumscribed and inscribed by the six then-known planetary orbits. Saturn’s orbit is in a sphere circumscribing a cube, which is inscribed by Jupiter’s orbital sphere, which circumscribes a tetrahedron, and so forth. Glynn seems unaware that the argument was a standard Pythagorean one, dating back at least to Plato, for both the number and ordering of planets. All 16th-century astronomers knew that tradition of argument well. What Kepler did was verify that the old Pythagorean argument still worked for the heliocentric model in which Earth and the Sun changed places.

Those gaffes are actually clues to an important problem with the history presented in *Elegance in Science*. Save for one case in the final chapter, Glynn labels only theories we currently judge to be correct as elegant. But consider, for example, Ptolemy’s mathematical astronomy. Our modern framework is

clearly superior to the Aristotelian natural philosophy that framed Ptolemy’s mathematical astronomy: With it, we can solve problems the Aristotelians couldn’t; the modern formulation has a markedly increased precision, predictive power, and fruitfulness, and it provides a higher degree of coherence to experimental data. All those and more, suggests Thomas Kuhn in *The Structure of Scientific Revolutions* (3rd edition, University of Chicago Press, 1996), are suitable criteria for judging a framework and endorsing a new one, if it outperforms its rivals.

Within the Aristotelian framework, however, Ptolemy’s geocentric model is extremely elegant and was recognized as such for more than 1400 years. Moreover, Aristotle’s theories of natural place and motion also have an elegance and simplicity that was positively entrancing from at least the Hellenistic period to the early 17th century. Even Ptolemy’s equant had a mathematical elegance that lasted for centuries; indeed, in his *De revolutionibus orbium coelestium*, Nicolaus Copernicus realized he had to challenge that elegance if his own ideas were to be taken seriously.

Without the relevant historical context, Glynn misses the long-standing elegance of Ptolemy’s model and the venerable Pythagorean argument. In such instances, the author fails to heed his own warning that “to appreciate the elegance of a theory or an experiment, the reader needs to be aware of the state of play in the relevant field at the time. . . . [E]ach topic has to be seen against its historical background” (page xv).

Despite that problem, *Elegance in Science* arrives at a plausible historical conclusion. Namely, elegance may be a powerful motivator for constructing a theory or experiment, “but don’t get seduced by elegance: an elegant theory is not necessarily true” (page 234).

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