

REVIEWS

Back to first principles

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make the colour mnemonic “Roy G Biv” pronounceable.

The book’s title comes from a wonderful chapter in which Wilk traces the history of fictional “death rays” back more than 200 years, to an 1809 novel in which the author Washington Irving – best known for *The Legend of Sleepy Hollow* – armed his interplanetary invaders with beams of concentrated sunlight. The “heat rays” of H G Wells’ better-known Martian invaders did not arrive until 1896. “Disintegrator rays” soon followed, and death rays of various types became standards of pulp-era science fiction, comics and films. In most cases, these rays killed on contact, leaving dead bodies but not the blood and guts of the deadly mechanized warfare that began with the First World War. Quoting

It’s an old-fashioned cabinet of wonders in book form, offered in the spirit of intellectual fun

the science-fiction critic Peter Nicholls, Wilk notes that their invention “may have resulted from a certain squeamishness, since it allows for a

maximum of destruction with a minimum of bleeding pieces to sweep up afterwards”. As a card-carrying laser and SF geek, I couldn’t ask for more.

How the Ray Gun Got Its Zap is not a big-picture, big-issue or deep-thought book. It’s an old-fashioned cabinet of wonders in book form, offered in the spirit of intellectual fun. It sent me down to the kitchen to see if my violet laser pointer would stimulate bright fluorescence from any of the leftover Christmas food colouring. The only glimmer of hope was from red cinnamon nonpareils, but I may put some coloured Jell-O on my grocery list.

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Between the lines

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Quantum pioneer

A new book by A Douglas Stone sets out to reclaim Einstein for quantum mechanics.

Einstein’s quantum side

The fact that Albert Einstein won his Nobel prize for explaining the photoelectric effect, and not for his special or general theories of relativity, is often regarded as an anomaly. The usual explanation for the Nobel committee’s decision is that the scientific establishment of the early 20th century was far too conservative to reward a truly revolutionary theory, so instead, it honoured Einstein for work that was both less controversial and less significant. The solid-state physicist A Douglas Stone, however, takes a different view. In his book *Einstein and the Quantum*, Stone sets out to reclaim Einstein for the other side of modern physics, noting that “for most of us quantum mechanics is the theory of everything”. The result is a remarkable thing: a book about Einstein that feels fresh, focusing as it does on the master’s ideas about statistical mechanics and blackbody radiation rather than, say, space-faring twins and $E = mc^2$. It helps that Stone, a first-time popular science author, is wonderfully quotable, producing such instant gems as “A good experimentalist can also be lucky. A good theorist, on the other hand, has to be right.” But really, it’s the physics of Stone’s book that enchants, as he ushers us through the subtleties of the ultraviolet catastrophe, quantum ideal gases and even Bose–Einstein condensation. Thanks to a few technical passages, the book is probably best suited to readers

who are already familiar with the basic principles of late classical and early quantum physics. However, in many cases, Stone’s explanations are better and more intuitive than those found in traditional textbooks; for this reason, *Einstein and the Quantum* would make excellent “further reading” for undergraduate courses in thermodynamics, modern physics or the history of science. Stone also has a knack for summing up complex ideas in a way that even novices will understand. At one point, he compares Max Planck’s predicament concerning blackbody radiation with that of an undergraduate who turns to the back of their textbook to find a correct answer “but can’t quite figure out how to get that answer based on the principles they are supposed to have learned”.

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Back to first principles

In any conversation about the philosophy of science, the word “reductionism” is seldom very far from the lips. In the words of Alastair I M Rae, this idea that a system can be understood by “reducing” it to its component parts – and that any physical laws that apply to the parts will also apply to the whole – forms “a central, if often unstated, assumption underlying almost every scientific statement”. Despite its importance, however, the term is probably used

more often than it is understood. Rae’s book *Reductionism* – one of a series of short “beginner’s guides” to topics that range from anarchism to volcanoes – aims to address this deficit. In addition to reductionism itself, the book also covers related ideas such as falsification, Occam’s razor and the principle of emergence. The last of these ideas suggests that complex phenomena (such as the shapes in a painting) “emerge” from simpler ones (such as individual brush strokes), and it is sometimes regarded as a philosophical challenger to reductionism – at least in the colloquial sense that “the whole is greater than the sum of its parts”. Rae, however, is a fully paid-up member of the reductionist fan club, believing that even very complex emergent phenomena, such as human consciousness, can be reduced to basic chemistry and physics, at least in principle. Physicist readers may wish to skim the book’s first few chapters, which tell a familiar (if rather comforting) story about how chemical properties “emerge” from the behaviour of individual atoms and electrons. Later chapters on biology and the application of reductionism to quantum measurement will be of greater interest, and Rae’s decision to conclude by discussing high-temperature superconductivity – an emergent phenomenon dear to his own heart – is a nice touch.

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