physics Nobelist.

The author describes a D.Sc. degree as the equivalent of a PhD (but don't they generally get to wear nicer-coloured academic robes?). On the other hand, she does an unusually good job of tracing out the path of stellar nuclear reactions from hydrogen to iron and beyond. A few other items left me wanting to verify names, dates, and all, for instance the statement that Ray Davis detected solar neutrinos in 1965, and that Otto Frisch thought of using "pure uranium" for a fission bomb, Frisch and Rudolf Peierls concluding that a few kilograms would be enough. —Virginia Trimble.

Quantum Drama: From the Bohr–Einstein Debate to the Riddle of Entanglement, by Jim Baggott & John L. Heilbron (Oxford University Press), 2024. Pp. 335, 24·5 × 16·5 cm. Price £26·99/$32·99 (hardbound; ISBN 978 0 19 284610 5).

Jim Baggott* is known mainly as a writer of popular-science books; the late John L. Heilbron as a historian of science. Heilbron lived in Copenhagen 1962–1963, he interviewed many of the founders of quantum mechanics, and archived and microfilmed their correspondence; he has also written a biography of Bohr[3]. They have teamed up for something in-between, a popular history-of-science book, more detailed than most popular-science books and a breezier read than most technical history-of-science monographs. It covers the time from the origins of quantum theory up to the present. Obviously, it can't be even close to a complete account in only a few hundred pages. Rather, as the subtitle states, it concentrates on the idea of entanglement, covering various interpretations of quantum mechanics, philosophical issues, experiments, and practical applications.

Except for the last with six, each of the four parts (which follow a nine-page prologue) has four chapters. The first part covers the early days (roughly from Planck's first work, conveniently in the year 1900, until the end of the 1920s) of quantum mechanics and provides a basic introduction to the topic. The latter can be found in many other books; the former, with more emphasis on the people involved, is not as common in books at this level. The second concentrates more on the main theme of the book, covering events from the fifth Solvay conference in 1927 until about the end of the 1930s, with the famous Einstein–Podolsky–Rosen paper and Schrödinger's cat playing prominent roles. Quantum mechanics is no longer just a system of rules for calculating experimental quantities, but has become a philosophical subject, with topics such as the measurement problem, the reality (or not) of macroscopic superpositions, the uncertainty relation, and so on, occupying the best minds in the field, not always agreeing. The most famous such disagreements are the famous Bohr–Einstein debates. (I recently read that the traditional view is, in the physics community, that Bohr is seen as having been right and Einstein wrong, whereas in the philosophy community it is the other way around. However, that simple dichotomy is as much an oversimplification as each premise on its own.) The title comes from a quotation from Bohr: "At the next meeting with Einstein ... our discussions took quite a dramatic turn." The third part, picking up after the distraction of World War II (in which many of the key players were involved in more practical pursuits) and continuing until about the end of the 1950s, introduces the alternative approaches of Bohm and Everett. Interesting is the degree to which some of the 'non-Copenhagen' pioneers followed those new

*I reviewed[1] a previous book[2] by Baggott in these pages.

approaches while at the same time a new generation (Weisskopf, Wheeler, von Neumann, Wigner, *etc.*) took over*: Bohr died in 1962, Einstein in 1955, Fermi in 1954, Schrödinger in 1961, Pauli in 1958. (Interestingly, some of the earlier generation died much later, *e.g.*, de Broglie in 1987, Dirac in 1984, Born in 1970, Jordan in 1980, von Weizsäcker in 2007, but in their last decades they were no longer leading the discussion in the field.) There is also a good discussion of attitudes in the field as expressed at conferences (where opinions are often more clearly on display than in journal articles). The last part introduces John Bell and the current importance of his work, *e.g.*, the experiments by the winners of the 2022 Nobel Prize in Physics (Clauser, Aspect, and Zeilinger), quantum cryptography, and quantum effects observable in (almost) macroscopic objects. In between is an interesting discussion of popular-level mysticism in connection with quantum mechanics (Capra[4], Sarfatti, Zukav[5], *etc.*). While that is often (correctly, in my view) looked down upon, it is important to remember that Schrödinger was very interested in eastern mysticism, Pauli in the psychological theories of Jung, Bohr put yin and yang on his coat of arms, and so on. (At least Schrödinger's 'mystical side' might be more akin to the religion of Lemaître, who was a Catholic priest yet seemed to be able to separate that from his work in cosmology, which has also been the case among some more modern openly religious cosmologists such as John Barrow and George Ellis.)

While there are few equations in the book, the fourth part goes into more detail than one might expect in explaining the ideas of Bell and the experiments of Clauser, Aspect, and Zeilinger. While the book can't cover everything — and doesn't attempt to — all the same, many readers will probably come across concepts and people usually not mentioned in overviews of (the history of) quantum mechanics, such as Grete Hermann. As such, it is complementary to many other books broadly covering similar ground. It is also better written than most books I've reviewed in these pages. There are black-and-white figures scattered throughout the book. Twenty-five pages of endnotes are mostly references to the sources listed on twenty-seven pages. The thirteen-page small-print index is especially thorough, especially for a 'popular' book, and demonstrates again that this book is a cut above most broadly similar books, both in terms of content and in terms of presentation. It should appeal to a relatively wide readership, especially due to its combination of detail and readability, including, despite the lack of astronomy, readers of this *Magazine*. — Phillip Helbig.

References

(1) P. Helbig, *The Observatory*, **139**, 128, 2019.
(2) J. Baggott, *Quantum Space: Loop Quantum Gravity and the Search for the Structure of Space, Time, and the Universe* (Oxford University Press), 2018.
(3) J. L. Heilbron, *Niels Bohr: A Very Short Introduction* (Oxford University Press), 2020.
(4) F. Capra, *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism* (Shambhala Publications), 1975.
(5) G. Zukav, *The Dancing Wu Li Masters: An Overview of the New Physics* (William Morrow), 1979.

Splinters of Infinity, by Mark Wolverton (MIT Press), 2024. Pp. 271, 23·5 × 16 cm. Price $29·95 (about £24) (hardbound; ISBN 978 0 262 04882 8).

While the title *Splinters of Infinity* might suggest otherwise, this book is a history of the debate between Robert Millikan and Arthur Compton about

*I use 'generation' here less in relation to the year of birth and more in relation to the period in which the person in question was an active participant in the field.