

Dark Energy for Everyone

The Weight of the Vacuum: A Scientific History of Dark Energy. Helge S. Kragh and James M. Overduin (Springer, Heidelberg, 2014). Pp. viii + 113. €42. ISBN 9783642550898 (paper).

This is an interesting historical overview of the development of ideas relating to vacuum energy. It is a well-written, easy read, and should appeal to anyone with an interest in dark energy, which should be all of us, since this is often claimed as the biggest mystery in modern physics. Kragh and Overduin have split the story into 12 chapters, tracing relevant ideas from the ancient Greek philosophers up to the present day.

The earlier chapters will be of particular interest to those already well versed in modern cosmology. They discuss early ideas of the vacuum and the aether. We learn about how the “zero-point energy” had its origin in an abandoned “second quantum theory” of Planck. We are then introduced to Nernst’s initial ideas on what was effectively vacuum energy. The authors do a good job of explaining these concepts in the context of modern physics. It is hard for us to understand why the first notions of energy in the vacuum were not taken more seriously a century ago, and hence, the authors try to help us place these ideas within physical views of the time. With the introduction of Lambda in general relativity, we are in more familiar territory, but nevertheless the authors manage to present several twists and turns that will be new for most readers. The connection between dark energy and the Casimir effect is explained clearly as is the connection that was slowly made (by Zeldovich and others) between Lambda and quantum fluctuations.

The last three chapters describe material that will be familiar ground for a large fraction of those likely to read this book, namely, a summary of the theoretical and observational developments behind variable Lambda and quintessence. Of course the developments of the last 20 years have been rapid, and the number of papers is fairly vast, so the authors can only scrape the surface (but given the wealth of relevant literature, it seems a shame there are so many self-citations here). The book does a good job of explaining that the story of the acceptance of dark energy as a reality is a complicated one. However, the accurate story is much more convoluted even than described here; it would take a much thicker book to do it justice.

There are certainly flaws in the book. Despite the historical narrative, a statement in the preface perpetuates the myth that dark energy was discovered in 1998. The early chapters (particularly the first three) are marred by a conspicuous lack of primary references; for example, one figure reproduced is labelled simply “from a book published in England in 1675” (p. 4). This lack of attribution makes these chapters less useful than they could be for serious students of science history. The book also seems to leap rather suddenly over several decades. Was there really no progress made in the 1940s–1950s? The history leading up to inflation jumps around a bit as well. There is no mention of the role of Dicke and others in discussing flatness and horizon problems in the 1960s. Only a few genuine errors are apparent, e.g., $w=0$ when $w=-1$ is meant, and a figure that is physically incorrect because it ignores radiation at early times (pp. 70, 107), and they stand out because of their rarity. One aspect entirely missing is the role played by the cosmic microwave background through comparing the Cosmic Background Explorer (COBE) normalization and galaxy clustering today, with Lambda cold dark matter

(Lambda-CDM) being preferred by several studies in the early 1990s. On the other hand, there are some incongruous comments on work that was quite peripheral to the main story (e.g. a baryon-only model).

Although the book provides a good basic introduction to the subject of dark energy, it is also a shame that the authors did not attempt to draw the material together into a final discussion. The book just stops. We are left wondering where this research area may be going next, with no help given by the authors.

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Egyptian Curiosities

An Eleventh-Century Egyptian Guide to the Universe: The Book of Curiosities. Edited by Yossef Rapoport and Emilie Savage-Smith (Brill, Leiden, 2014). Pp. xii + 698. €223. ISBN 9789004255647.

This beautifully produced book is a work of remarkable scholarship. The editors and publisher deserve considerable praise for making it available. In 2002, the Bodleian Library acquired an illustrated Arabic manuscript that represents a kind of cosmology in two books, the first dealing with the celestial realm and the second with the terrestrial world. The first book contains 10 chapters and the second, 24. What is of particular interest are the several astronomical diagrams, star charts, and maps, including two world maps. After the manuscript was publicized and made available online, a number of other copies of the work came to light. Some of these copies differ considerably; in particular, the Damascus copy consists of five books rather than two, making an exact determination of the original status of the work difficult. The editors have opted to consider the Bodleian copy the most “authentic” and have in the main followed it in their edition and translation.

According to the editors, the anonymous work was written in Fatimid Egypt sometime during the first half of the eleventh-century CE, and the Bodleian copy was made also in Egypt, *c.* 1200. Based on internal evidence, the dating seems sound, although exactly what the original work may have looked like and what diagrams it contained are far from clear. The dating and provenance of the work make it contemporaneous (or almost so) with two of Islam’s greatest scientists, Ibn Yūnus (d. 1009) and Ibn al-Haytham (d. *c.* 1040), both of whom also worked in Fatimid Egypt. But there the similarities end; this is a work quite different from anything written by Ibn Yūnus and Ibn al-Haytham, inasmuch as much of its astronomical information is placed within an astrological context and its geographical information is often accompanied with fanciful anthropological, zoological, botanical, and meteorological details. Of course there is nothing wrong with this (the study of “wretched subjects” is part of our calling), but it is important to emphasize upfront, as do the editors, that “[t]he author’s interest throughout the