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ESSAY REVIEW

Lectures on Classical Electrodynamics

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A review of **Lectures on Classical Electrodynamics**, by Berthold-Georg Englert, Singapore, World Scientific, 2014, 260 pp., $88.00 (hardback), ISBN 978-981-4596-92-3. Scope: textbook. Level: advanced undergraduate, postgraduate, early career researcher, researcher, teacher, specialist.

Although it is a close-run thing, lectures are the second most inefficient means of communicating useful information to students (the dubious distinction of the most inefficient belongs to the undergraduate laboratory session). Despite, or perhaps because of this, the lecture holds a special place in the affections of many, representing a mixture of performance, performance art, inspiration and exasperation; or perhaps a warm and tolerably safe place to sleep during daylight hours. These factors no doubt contribute to the uncertain status of the printed volume based on the lecture course. Sometimes this takes the form of a set of typed hand-outs, sometimes a tidied-up report of what was said in the lecture, sometimes a mystifying codex, and sometimes a unique record of a very special performance that would otherwise be lost. Happily, the new book of lectures by Berthold-Georg Englert on the subject of electrodynamics is a good one.

The book is a set of fleshed-out lecture notes on topics in electromagnetism, aimed at advanced undergraduates or graduates. The material begins with a review of Maxwell's equations, relativity, and Lagrangian mechanics. In a particularly effective early chapter, electromagnetic pulses are used to introduce the use of conservation laws. Most of the latter part of the course is devoted to the explanation of electromagnetic radiation, including the case of the antennae, synchrotron radiation, scattering and diffraction. There are also 96 problems covering material from each of the twelve chapters, along with some gentle hints (rather than detailed solution).

There are, of course, many excellent and authoritative textbooks on electromagnetism aimed at every level of expertise imaginable. The choice of topics here represents an interesting selection of subjects that are not only fascinating in their own right (and often poorly taught), but also ones that serve as a means to bridge the gap between the standard undergraduate treatment and the covariant approach to classical fields. This choice was partly inspired by a lecture course taught by Julian Schwinger from the early 1980s, but the book is packed with the author's own incisive commentary, which serves to make this much more than the repeated presentation of known material.

Characteristic of a lecture note volume, detailed, explanatory text is kept to a minimum, and there are relatively few diagrams. Instead, the emphasis is placed on the mathematics and, in particular, the many detailed steps required in several lengthy derivations. This, when done as well as it is here, is a strength of the lecture note volume over a traditional textbook, where the reader can be left lost in a tangle of equations that might suddenly appear amongst mellifluous discussion.

The book is a well-produced one with logical notation and clear layout. The figures are, for the most part, clean and intelligible line drawings, although they tend to be rather small. The necessary, but naturally unexciting, explanation of units in electromagnetism is kept clear and concise. Particularly, welcome are the full names and dates of the many scientists who have effects and equations named after them.

In summary, this book is a useful addition to the pedagogical literature on electromagnetism, filling a gap in many students' exposure to the subject. It will also be valuable to instructors who intend to devise their own modern lecture courses on these or similar topics. Finally, the book is a good example of how a lecture course can be transformed into a fine book for the benefit of all. Now, if you will excuse me, I'm off to find a lecture hall in which to have a nap.

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