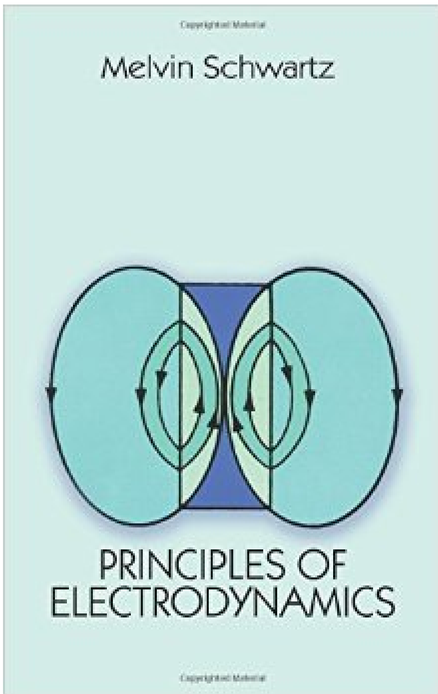
Principles Of Electrodynamics (Dover Books On Physics)



Synopsis

Unlike most textbooks on electromagnetic theory, which treat electricity, magnetism, Coulomb's law and Faraday's law as almost independent subjects within the framework of the theory, this well-written text takes a relativistic point of view in which electric and magnetic fields are really different aspects of the same physical quantity.Suitable for advanced undergraduates and graduate students, this volume offers a superb exposition of the essential unity of electromagnetism in its natural , relativistic framework while demonstrating the powerful constraint of relativistic invariance. It will be seen that all electromagnetism follows from electrostatics and from the requirement for the simplest laws allowable under the relativistic constraint. By means of these insights, the author hopes to encourage students to think about theories as yet undeveloped and to see this model as useful in other areas of physics.After an introductory chapter establishing the mathematical background of the subject and a survey of some new mathematical ideas, the author reviews the principles of electrostatics. He then introduces Einstein's special theory of relativity and applies it throughout the rest of the book. Topics treated range from Gauss's theorem, Coulomb's law, the Faraday effect and Fresnel's equations to multiple expansion of the radiation field , interference and diffraction, waveguides and cavities and electric and magnetic susceptibility.Carefully selected problems at the end of each chapter invite readers to test their grasp of the material. Professor Schwartz received his Ph.D. from Columbia University and has taught physics there and at Stanford University. He is perhaps best known for his experimental research in the field of high-energy physics and was a co-discoverer of the muon-type neutrino in 1962. He shared the 1988 Nobel Prize in Physics with Leon M. Lederman and Jack Steinberger.

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Customer Reviews

Since I’ve first heard about electricity and magnetism, people always said me that the electric and the magnetic field are nothing less than two sides of the same coin. I really wasn’t convinced of that. I’ve entered at college. Nothing. And I took a (pitiful) undergraduate course on Electromagnetism. Nothing. Not even the Maxwell Equations and the explanation about how they demonstrate the existence of EM waves convinced me. It always appeared that The electric and the magnetic field were two separated things, no matter how much relations between them. I tried even graduate books (say, Jackson), and nothing.Then, Here comes the light... Schwartz’ chapter about electric field and relativity, where he concludes merely from Coulomb law and Lorentz invariance that MUST BE A MAGNETIC FIELD, then comes with the EM Field Strength tensor and derives (also from Lorentz invariance)... the very Maxwell’s equations! Unbelievable! Why didn’t they tell me this before? Or, why don’t they teach EM like this? All this not to mention the section about an insight over determining nuclear shape from electric quadrupole moments, the tensorial form of EM laws, Multipole expansion, all that with a remarkable physical insight that is so rare in EM texts (maybe other exception is Landau’s Classical Theory of Fields). I only regret the absence of a Lagrangian-Hamiltonian formulation for EM, Green’s functions, and gauge invariance with his properties and how this reflect in the formulation of EM laws. But I believe that these topics can be well covered in Landau’s text (I really hope so, so I don’t need to rely on the insight-less text from Jackson). After all, the physical unity, simplicity and beauty of Schwartz’s book is nearly unbeatable. 5 stars "cum lauda"!

This book is the best introduction to advanced electromagnetic theory I have ever encountered. The author does a masterly job at simplifying the mathematics without over-simplifying the physics. If you’re looking to gain a deep understanding of electromagnetics and its relation to the theory of relativity, this book is for you!

I read this book cover-to-cover a few years ago as a review of E&M theory. Overall, it was a good technical read. I will offer a few notes:1. This is a Dover reprint of a classic text (circa 1972), but then again E&M theory is a lot older than that, so....2. The book is a physics text--not an engineering text, so it is heavy on theory and light on applications. Don’t expect to see any Smith charts.

Coverage of transmission lines, wave-guides, etc., is nominal.3. The book is heavy into vector calculus, so come with the requisite mathematical background.4. The author isn't afraid of diving into some serious mathematical machinations. My favorite is the derivation of the plane-wave equation in Chapter 6--it runs on for five pages (in fine detail).5. The book reads rather dry (yes, I know its a technical book--but it is dry even for a physics text). The only particularly memorable deviation from the classical theory was a description of the method used to search for magnetic monopoles in moon rocks (which was a hot topic in 1972--evidently).For the modest price, this Dover reprint provides an economical volume for your home technical library. Regard it as a theoretical tome--not a 'how to' book.

I took Freshman Physics from Schwartz at Stanford in 1975. I came across these reviews while trying to see if his book was still in print.Schwartz was the clearest teacher I had in my career - and I had some great ones, Marty Perl, Ted Haensch, Mahiko Suzuki, John Whelan, Brian Pippard and Dave Jackson himself for Quantum Mechanics, all great and Schwartz was better. We figured out about week two that he was basing his freshman class on this book.Schwartz said later that Steve Jobs audited this Freshman physics class. If so, Jobs did not stand out, we were too fascinated and terrified by Schwartz to notice the Apple founder in our midst.If you know vector calculus and want to really understand E+M, read this book - there is not a wasted word in it.I'm buying a 3rd copy to lend out to students.

Melvin Schwartz won the Nobel Prize of physics in 1988 by his experiments (with Leon Lederman and Jack Steinberger) on this most elusive of all physical objects, the neutrino. We must be grateful for the fact that he found time to write this precious little book on electrodynamics. It is a gem . I compare it to the very best expositions: Landau-Lifshitz's "Classical Theory of Fields" and the first chapter of the first edition of Heitler's "Quantum Theory of Radiation" .

This book is truly superb. I am a self-studier of physics and found this to be one of the best books on any subject in physics that I have read. Somehow it strikes a balance between explaining ideas at an introductory level yet takes a very mature and deep insight into the subject. As other readers have mentioned, the development of almost all of electrodynamics from Coulomb's Law, the Principle of Special Relativity, and a little 'intuition' and 'aesthetics' makes this book transcend the level of other physics texts and even makes it deeply philosophical.Very few words are wasted, and the careful reader can really master the field of electrodynamics with this book. Little prerequisite knowledge is assumed; probably multivariable calculus (with vector analysis) and introductory newtonian mechanics are all that are absolutely needed. One possible exception is that the discussion on special relativity is a little hard to follow if you have never had any exposure to it before. Thus, I would suggest having a good grasp of SR, especially including four-vectors (and ideally four-tensors) if possible before undertaking this book. One definite criticism I had of this book is its use of imaginary numbers in the definition of Minkowski four-vectors. Although this was Minkowski's original idea, it is virtually universally abandoned (as it should be) in every treatment of general relativity; because of this, almost all modern books on GR abandon its use in SR. It is too bad that it is used here, but this is really my only criticism of an otherwise near perfect book.