gesture—say, the destruction of 1000 warheads—without significant damage to our security. And we would encourage the other side to put in a defense at the same time, and reduce its arsenal by 1000 weapons, as we had done. And so we would proceed together toward the abolition of nuclear weapons, in a stepwise, carefully phased, simultaneous reduction of the two arsenals, without compromise to the security of either nation.

So the process starts, and leads to the abolition of nuclear weapons, that can be undertaken once a defense is in place. The next step, and the one after that, and all that follow down to the end—the abolition—require continuing cooperation between the two nations, in carefully negotiated and parallel deployments of defenses, alternating with the incremental reductions of the two arsenals of destruction. That is the road to a nuclear-free world.

The reader may guess what the US response would be to Soviet acquisition of a defense with a promise of later reductions in their offensive force. No, this fairy tale is *not* the path to a nuclear-free world; it is a prescription for a build-up of Soviet forces such as we have never seen, forced by that same fear of being disarmed that we would feel in the face of a Soviet promise to deploy a good defense as soon as they discovered how to do so.

Our real hope is for reduction in warheads to one-tenth their current numbers by supplementing the ABM-treaty commitment not to build weapons to threaten the strategic retaliatory forces of the other side.

For a summary characterization of Jastrow's book I repeat the written judgment of a deputy chairman of the Fletcher Commission, Major General John C. Toomay (retired from the US Air Force) on a Defense Department document transmitted June 1984 as "Comments on Directed Energy Missile Defense in Space," and prepared in part by those on whom Jastrow relies: This "is not a competent document. It contains falsehoods, irrelevancies, and misinterpretations."

Gauge Theory of Elementary Particle Physics

Ta-Pei Cheng and Ling-Fong Li
430 pp. Oxford U. P., New York, 1984.
$39.00

The elevation of a proposed model of a natural phenomenon to the more illustrious status of a theory is often marked by two events. One is the widespread conviction that further experimental tests, while always welcome, will, like their predecessors, conform to the predictions of the model. The other is the appearance of textbooks that describe the theory and have a potential lifetime of more than a few years.

The standard model of the electroweak and strong interactions, which was consolidated in the early 1970s, is now making this transition. The most recent experiments at the proton–antiproton collider at CERN (those of the UA1 and UA2 groups) have, with the discovery of the W and Z mesons, dramatically confirmed the predictions of the $SU(2)\times U(1)$ unified gauge theory of the electromagnetic and weak interactions. They have also subjected quantum chromodynamics, the SU(3) color gauge theory of the strong interactions, to new tests. Most important, they have found no new phenomena that cannot be explained by the standard model combining these theories.

This book, appropriately titled *Gauge Theory of Elementary Particle Physics*, is an excellent example of the second kind of event. The authors, Ta-Pei Cheng and Ling-Fong Li, respected practitioners in the field, have written a textbook that emphasizes the theory of modern particle physics. This is a welcome change from older books, which contain more descriptive accounts of observed phenomena without coherent expositions of the underlying theoretical structure. Advanced graduate students and anyone else interested in the structure and applications of gauge theories will find this book very useful and instructive.

To fully understand the modern gauge theories one must be conversant with quantum field theory—the natural language of elementary particle physics. A large part of this book is therefore devoted to a survey of the basic formalism of quantum field theory as well as an extensive discussion of the more advanced concepts and methods of modern gauge theories. Although Cheng and Li presume some acquaintance with the subject, the reader will find a concise review of diagrammatic perturbation theory, path-integral quantization, group theory and renormalization theory. The more advanced concepts—gauge symmetry, chiral symmetry breaking, the Higgs mechanism, asymptotic freedom and the renormalization group, the discoveries of which provided the foundation for the standard theories—are treated in greater detail. The exposition of these subjects is judiciously combined with applications to the standard theory in a way that brings life to what otherwise might be dull formalism.

The final chapters of the book, which discuss attempts at grand unification

and other topics of current research, will inevitably become rapidly dated. However, the bulk of the text will remain, for a long time to come, an excellent introduction to the comprehensive gauge theory of the electroweak and strong interactions—now referred to irreverently as low-energy physics.

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Magneto-Solid Mechanics

Francis C. Moon
436 pp. Wiley, New York, 1984. $59.95

Electrodynamic forces on current-carrying conductors and nearby ferromagnetic materials have been the domain of electric-power engineers. An understanding of these forces and their action on metals was crucial in the invention and development of generators, motors, transformers and transmission lines. There are several good books available that deal with the electromechanics of power engineering. Francis Moon wisely avoids this area and concentrates instead on novel electromagnetic technology for which there exist few or no text and reference books.

Metal forming by induced high-current pulses is one example. Magnetically levitated trains is another that is just reaching commercialization. Many readers will be interested in Moon's treatment of powerful electromagnets for magnetohydrodynamic generators, the containment of plasma fusion, and large-scale inductive energy storage. There is mention of what impedes our quest for ever stronger magnetic fields to probe the behavior of matter. Most intriguing of the new applications of pulsed magnetic fields mentioned in the book are the railguns and mass drivers (coaxial accelerators) that are proposed for the artillery of "Star Wars," and one day may be used to launch payloads from Earth into space without burning up tons of rocket fuel. Moon also mentions the first successful applications of superconductivity to magnet design, and particularly to magnets used in nmr scanning, which provides a great deal of information complementing x-ray diagnostics.

Nothing could conceal this fascinating range of topics in electromagnetics more than labeling it "magneto-solid mechanics." The title conjures up a mathematical nightmare in which the tensor equations of elasticity meet the ethereal electromagnetic field. There is a good deal of this mathematical nightmare in the book. It makes an excellent training ground for applied mathematics. Fortunately, the text also contains many working formulas of great practical relevance, interlaced