ANOTHER PLACE TO TURN FOR ACCELERATOR BASICS

Introduction to The Physics of High Energy Accelerators

D. A. Edwards and M. J. Syphers
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Reviewed by William Barletta

The field of accelerator physics has been marked by a singular lack of archival literature. Accelerator builders have generally been content to "publish in steel and concrete," relegating much of the supporting analysis to internal laboratory reports. Proceedings of major accelerator conferences constitute a somewhat more accessible source of materials written for the historical record, but textbooks have been nearly nonexistent.

Compounding the problem is the way most accelerator physicists enter the field: not via formal university education specific to accelerator physics, but rather from on-the-job learning after switching from other disciplines. University courses have been few and limited to a small number of institutions. Consequently, the writer of a textbook on accelerator physics faces the challenge of selecting and organizing appropriate material without benefit of a broad context of synthetic and pedagogical material on which to build.

The temptation to try to cover all important topics, then, is enormous. To their credit, Donald Edwards and Michael Syphers have avoided this pitfall, focusing carefully on physics issues central to the design of proton storage rings. The authors are well matched to the task: Edwards (recently retired) was associate director for accelerators at the Superconducting Super Collider Laboratory, and Syphers has been leader of the SSC's accelerator theory group. The book grew out of courses they have given at the US Particle Accelerator School (a "classroom without walls" that meets twice a year at various sites).

The authors write for advanced undergraduates in physics and engineering. They guide the student carefully through the mathematics, preferring clarity of physical principles to strict mathematical rigor. The text is equally well suited to a graduate course or self-instruction, especially if supplemented with a list of primary source materials.

Unfortunately, the bibliography is general and meager (only 17 references); other excellent books on accelerator and beam physics, such as *Charged Particle Beams* (Wiley, 1990) and *Principles of Charged Particle Acceleration* (Wiley, 1986) by Stanley Humphries Jr, *The Physics of Charged-Particle Beams* (Oxford U. P., 1988) by John Lawson and *An Introduction to the Physics of Intense Charged Particle Beams* (Plenum, 1982) by Ronald Bruce Miller, go unmentioned. In particular, while Edwards and Syphers have avoided a too-shallow treatment of too many technologies, their synopsis of the types of accelerators in Chapter 2 is all too brief. A detailed bibliography of this topic would be a substantial improvement.

Among the highlights are a clear discussion of phase stability and an extended section on preserving beam emittance in hadron storage rings. The problem sets expand upon many important points only hinted at in the main text. Thus the authors encourage the student to develop a strong, active knowledge of the subject through analytical and computer calculations. The computational problems related to the effects of sextupoles and octupoles provide especially instructive examples of the subtleties of nonlinear effects upon transverse motion.

In contrast, the book's presentations of the effects of synchrotron radiation and space charge are too brief. To learn about synchrotron radiation, the student would be better advised to read Matthew Sands's outstanding monograph, *The Physics of Electron Storage Rings—An Introduction,* a Stanford Linear Accelerator Center publication (1971). However, while Edwards and Syphers may not quite match Sands's elegance of physical explanation, they have written a thoroughly readable and modern treatment of their chosen topics. Their book is a much needed contribution to the literature of particle accelerators and beam physics.

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Physical Properties of III–V Semiconductor Compounds: InP, InAs, GaAs, GaP, InGaAs and InGaAsP

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Over the last decade Sadao Adachi has written several useful and extensive review articles on material parameters for a range of III–V compound semiconductors, such as antimonides and arsenides. It is very convenient for researchers that he has now expanded the review articles into a book. The title of the book, however, sounds more inclusive than the book's actual contents, which cover mainly properties of InP, $In_{1-x}Ga_xAs_yP_{1-y}$ and $In_{0.53}Ga_{0.47}As$, whose lattices are matched to that of an InP substrate.

The III–V compound semiconductors GaAs and InP and their related alloys are important to a variety of photonic and electronic applications. In particular, a combination of $In_{1-x}Ga_xAs_yP_{1-y}$, $In_{0.53}Ga_{0.47}As$ and InP is used to make light emitters and photodetectors for fiber-optic