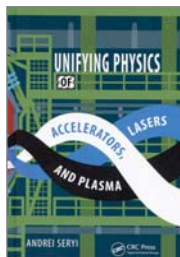


Unifying Physics of Accelerators, Lasers and Plasma

Andrei Seryi

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Accelerators drive lasers, lasers drive plasmas, plasmas drive accelerators—and the reverse processes are true as well. The concept of radiating beams connects the three topics and serves as an organizing principle for Andrei Seryi's thoughtful and delightful text, *Unifying Physics of Accelerators, Lasers and Plasma*.

Seryi's tome, with its overarching motif of unification, reads like an encyclopedic of accelerator science. Since it also features fundamental topics from laser and plasma physics, it should engage a broad range of interests, starting at the senior undergraduate level. It is amazing that Seryi was able to produce a text of such immense breath in fewer than 300 pages. He even ventures into the realm of microbiology: His concise description of DNA molecules' response to radiation is essential for understanding the efficacy of x-ray, ion, and proton therapies.

Seryi is one of the premier accelerator physicists of our time; his leadership at SLAC was instrumental in the establishment of the Facility for Advanced Accelerator Experimental Tests. His involvement in that and many other accelerator projects has given him a unique perspective from which to examine the big picture. He is currently director of the John Adams Institute for Accelerator Science, a research center associated with the departments of physics at Oxford University, Royal Holloway University of London, and Imperial College London.

Unifying Physics of Accelerators, Lasers and Plasma discusses a wide variety of accelerator topics without the complication of advanced mathematics. (Anyone interested in the details of accelerators should check out Helmut Wiedemann's excellent two-volume textbook, *Particle Accelerator Physics*, Springer, 1995 and 1999.) Especially informative are Seryi's historical notes, including credits to physicists from Russia and the other republics of the former Soviet Union. A

plethora of accelerator innovations have emanated from that part of the world, often without receiving proper note.

For example, most accelerator physicists know that Gersh Budker proposed electron beam cooling in 1967 at the Institute of Nuclear Physics in Novosibirsk, but many may not be aware of the 1944 prediction of synchrotron radiation by Dmitri Ivanenko and Isaak Pomeranchuk. That earlier work is especially noteworthy given the international excitement over synchrotron radiation sources. One note in the book needs clarification: The first of the second-generation synchrotron radiation sources was not the Synchrotron Radiation Source (SRS) at Daresbury, England, but Tantalus, which started operations in 1968 at the Synchrotron Radiation Center in Wisconsin (although the SRS was the first to produce x rays).

In his book, Seryi advocates the not-so-well-known TRIZ method, a Russian acronym for "theory of inventive problem solving." Starting in the late 1940s, Soviet engineer and inventor Genrich Altshuller developed TRIZ while studying thousands of patents and patent applications in a quest to understand what makes a patent successful. In short, the TRIZ method searches for pairs of "contradicting" parameters, in which improving one requires a process that makes the other worse. Once one identifies a set of such parameters, the method looks inside and outside the field of interest to arrive at the best solution for improving the first parameter. Seryi argues for making a wider adoption of that approach for scientific innovation.

Many books provide cut-and-dried problems that have definite quantitative solutions. However, with his end-of-chapter exercises Seryi takes an unusual approach. He offers thoughtful exercises with open-ended solutions that should provoke engaging discussions followed by in-depth analyses. Thus, wrestling with the exercises mimics the work of ac-

tual researchers. An excellent example is the problem that asks students to define approximate parameters of a second-generation synchrotron radiation source that produces 10-keV photons.

Among the book's few shortcomings is that Seryi only makes passing references to "ultimate" storage rings and he offers no substantive discussion of multi-bend achromats, the technology that is driving what many are calling the new fourth-generation synchrotron radiation source. Arguably the field's most exciting innovation in recent years, multi-bend achromats are designed to achieve significant reductions in the product of electron beam size and angular divergence; the improved beam leads to much brighter emitted radiation.

Those omissions aside, *Unifying Physics of Accelerators, Lasers and Plasma* is a must-have for every student and practitioner of accelerator science. It is a quick reference guide and provides solid, intuitive discussions of what are often quite erudite concepts. I enthusiastically applaud this outstanding book.

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Crystal Clear

The Autobiographies of Sir Lawrence & Lady Bragg

Edited by A. M. Glazer and Patience Thomson

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As promised on the book's back cover, *Crystal Clear: The Autobiographies of Sir Lawrence & Lady Bragg* "takes you behind . . . the life of one of the most prominent scientists of the twentieth century," William Lawrence Bragg (commonly referred to as Lawrence), and features unpublished autobiographies by him and his wife Alice, "a public figure in her own right." Intended only for the family, the autobiographies contain numerous insights into Lawrence's science, Alice's public service, and their family. The volume was edited by crystallographer A. M. Glazer and by the Braggs' daughter Patience Thomson, who provides stories that illuminate and enchant. Here I concentrate on Lawrence's account.