

Schrödinger: Life and Thought

Walter Moore

Cambridge U. P., New York,
1989. 513 pp. \$39.50 hc
ISBN 0-521-35434-X

A friend asked me last year whether I had seen the new Schrödinger biography, then in visible astonishment added, "It contains pictures of five of his mistresses and of two of his illegitimate daughters!" Having studied in Vienna, it came as no surprise to me that Schrödinger had been a ladies' man; that was common knowledge there. So he also had illegitimate children. That can happen in the "best of families." Yet, impelled by an admittedly base form of curiosity, I looked for the book in question on my next time in the bookstore. Written by Walter Moore, a professor emeritus of physical chemistry at the Universities of Indiana and Sydney, and published by Cambridge University Press, the book has a highly scholarly appearance, formulas and all. After reading a few pages here and there, I bought it. It is really two books in one: a clear, elegant and complete account of Schrödinger's scientific life and achievements, and a detailed and insightful account of Schrödinger's private life.

On the scientific side we get the fascinating history of the work that culminated in the epochal papers on wave mechanics. Then, there is Schrödinger's famous booklet *What is Life?*, which attracted Francis Crick and James Watson—and who knows how many others—to molecular biology. To be sure, the book reviewed here includes much more, but maybe nothing to invalidate what Richard Feynman once told me: "Schrödinger was the Harry Truman of physics, not obviously destined for greatness, but one who certainly lived up to the demands when his time came." Then there are the "assistants," the likes of Fritz London, Max Delbrück and Jan Tinbergen, and the peers, including Albert Einstein. The not unconflicted Schrödinger-Einstein friendship survived a dark period of European history and though both men behaved honorably, there was some strain caused by a letter Schrödinger wrote to the *Graz Tagespost*, which that newspaper took the liberty of publishing under the crass headline "Confession to the Führer." Further strain developed during the competition involved in the premature unification attempts in the late 1940s. There is the dramatic sequence of events that bring the Schrödingers from Berlin to

Graz and then to Dublin at the urging of Eamon de Valera.

And then there is the story of Schrödinger's private life. This story comes to life in these pages, always backed up by Moore's careful and extensive research. But Moore also reveals himself as a first-rate storyteller. And what a story it is!

Samples:

▷ Over Christmas 1925, Schrödinger writes the wave mechanics papers at a villa in Arosa, where he stays accompanied by a woman (definitely not his wife) whose identity remains a mystery to this day. Eat your heart out "Dark Lady of the Sonnets."

▷ Though in highest demand following the creation of wave mechanics, he takes time out to tutor the pubescent Junger twins, Ithi and Withi; years later one of them is to "almost" bear him a child.

▷ For all this to be possible, the Schrödinger marriage had to be an "open" one. The big surprise is that it was open at both ends: "Anny [Mrs. Annemarie Schrödinger] would find in Hermann Weyl a lover to whom she was devoted body and soul, while Weyl's wife Hella was infatuated with [experimental physicist] Paul Scherrer."

Reading all this, what comes to mind are the numerous books on Alma Mahler-Werfel-Gropius, which study this good woman on account of the passion she elicited from three such distinguished artists (and some others on the side). But then Schrödinger was a much better physicist than Franz Werfel ever was a writer, and a good case could be made for Hermann Weyl having been a much greater mathematician than Gustav Mahler was a composer, never mind Gropius. So how is it that we learn about all this only now? How is it that Mrs. Schrödinger is not the subject of studies and novels? Maybe the answer has to do with the idealized picture of scientists that our society clings to, against all evidence. Just as an artist is given automatic license, indeed is goaded, to excess in drink, drugs and sex, a scientist is pictured as cool, aloof, objective, unemotional and devoted to his science, to the exclusion of everything else. We know this to be false. Scientists are emotional, for after all what is the meaning of devotion in the absence of emotion? And yes, the scientist is as prone to excess as the guy next door, and probably for the very same reasons. It is refreshing to once have the veil lifted and to see the heroes of yesterday as they were, and not as society had decided they must or should have

been. Moore is to be congratulated for this.

This portrayal does not in any way detract from Schrödinger's tremendous achievements. And if Schrödinger emerges as a libertine, he is in good company: Saint Augustine, Mozart, Wagner and so on.

As in all such stories there are in this one elements of true sadness and near-tragedy. It appears that Schrödinger used his marriage as a shield against deeper forms of commitment: A love poem, it seems, was as far as he would go. This complex business is treated with insight and tact in the book.

Some time after I read through this book, I ran into the friend who brought it to my attention in the first place. He was still visibly disappointed, not by Moore's beautiful book, but by Schrödinger's behavior. He had patterned his own life according to the "cool devotion to the exclusion of all else" philosophy.

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Superconductor Electronics: Fundamentals and Microwave Applications

J. H. Hinken

Springer-Verlag, New York,
1989. 158 pp. \$39.00 hc
ISBN 0-387-51114-8

Superconducting Quantum Electronics

Edited by V. Kose

Springer-Verlag, New York,
1989. 299 pp. \$49.50 hc
ISBN 0-387-51176-8

Superconducting Electronics

Edited by Harold Weinstock
and Martin Nisenoff

Springer-Verlag, New York,
1989. 441 pp. \$75.00 hc
ISBN 0-387-51521-6

Superconducting electronics offer the ability to measure electromagnetic quantities at sensitivities unapproachable by any other technique. Since the introduction 20 years ago of the first commercial superconducting device—the SQUID—superconducting instrumentation has been routinely used in such diverse applications as medicine, materials science and oil exploration. Higher-frequency applications find superconducting electronics in radioastronomy and metrology. It was primarily the speed

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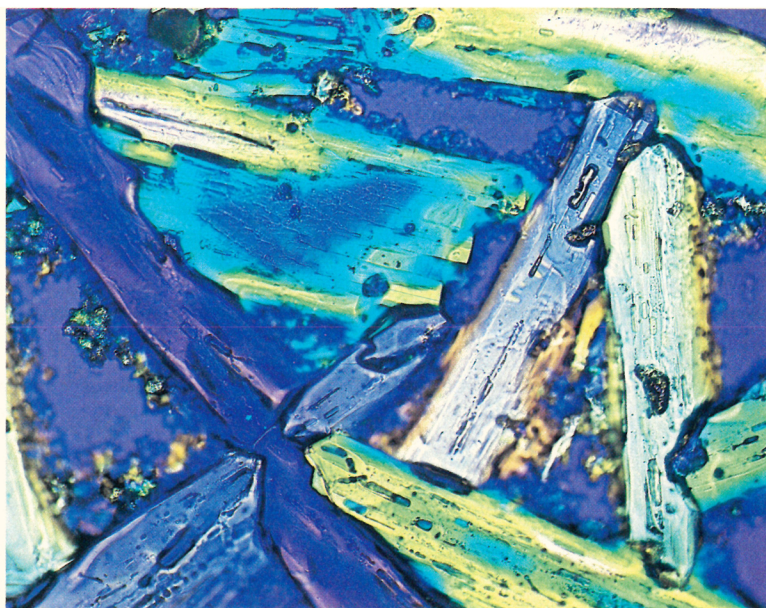
advantages of superconductivity in digital applications that motivated the IBM Josephson computer program. Until recently, superconducting electronics has been a niche application, used only where its advantages outweighed the difficulties of working within a cryogenic environment necessary for operation.

With the advent of high-temperature superconductivity, there has been increased interest in superconducting electronics in general. The possibility of high-temperature superconducting devices operating at near-terahertz frequencies could extend superconducting electronics into entirely new measurement regimes. Simultaneously, the emergence of biomagnetic applications is creating a significant commercial market for the traditional low-temperature devices.

The theoretical aspects of superconducting devices are covered extremely well in texts such as *Superconducting Devices and Circuits* by Theodore van Duzer and C.W. Turner (Elsevier, New York, 1981). Unfortunately, there has been no single source available that covers the applications side nearly as well. Three books from Springer-Verlag focus on devices and applications from the experimentalist's view.

The subtitle of *Superconductor Electronics: Fundamentals and Microwave Applications* gives its focus: microwave devices. It is an excellent translation of the 1988 German edition *Supraleiter-Elektronik* with added information on high-temperature superconductivity. *Superconductor Electronics* is directed at the researcher whose interest is in high-frequency applications of superconductivity. The discussions of superconductor-insulator-superconductor, or SIS, mixers and Josephson junction voltage standards are excellent. Another outstanding section is titled "Materials and Production Methods." Its discussion of high-temperature superconductivity is good, but only focuses on yttrium-barium-copper-oxide materials. As would seem appropriate for a book on high-frequency applications, only a few pages are devoted to devices or applications in the lower frequencies, such as SQUID systems. Hinken's discussion of refrigeration is good, especially for microwave receivers. *Superconductor Electronics* is quite readable and would make an excellent text for a graduate course on high-frequency applications.

Superconducting Quantum Electronics, edited by Volkmar Kose is a compilation of chapters written primarily by a number of German re-



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searchers. The focus is on detectors and applications. The first of the book's three sections focuses on fundamentals of the Josephson effect, the second deals with fabrication techniques for SQUIDS and junctions. The chapter on high- T_c Josephson contacts and devices is almost entirely concerned with what used to be high-temperature materials: NbN and Nb₃Ge. The book also includes a discussion of 77-K SQUIDS fabricated from bulk YBCO compounds. The use of SQUIDS for biomagnetic measurements is briefly discussed, with an emphasis on thin-film gradiometers. The rest of the second section deals with high-frequency applications and scanning electron microscopy studies. The final section of *Superconducting Quantum Electronics* discusses the use of superconducting electronics in voltage standards, current comparators and shift registers. The impact of high-temperature superconductivity is also discussed.

One strength of *Superconducting Quantum Electronics* is its discussion of fabrication techniques. In summary this book covers well those topics it discusses, but should not be considered a review of the entire field. It does not go into the same depth as either of the other two texts reviewed here.

An outgrowth of a NATO Advanced Study Institute, *Superconducting Electronics* should become the standard reference text on SQUID applications. The chapter authors are expert in their knowledge of the topic: The editors, Harold Weinstock and Martin Nissenoff, chose some of the best in their fields. If there is a bias in *Superconducting Electronics*, it is towards the lower-frequency applications. No other text covers this aspect of superconductivity in such depth. The book's only shortcoming is that the higher-frequency applications (microwave and millimeter regimes) are not covered as thoroughly as they are in Hinken's text.

Superconducting Electronics starts with excellent theoretical reviews on superconductivity, quantum interference in normal metals and tunneling. The chapter on fabrication of both low- and high-temperature superconductivity is quite good. *Superconducting Electronics* covers both analog and digital applications in depth. Biomagnetism, nonlinear properties, SIS junctions, signal processing, Josephson large-scale-integration technology and superconducting field-effect devices are just some of the topics covered.

The chapters on SQUIDS by John Clarke and Gordon Donaldson are to

be commended for their readability and ease of understanding. *Superconducting Electronics* deals not only with devices from the experimenter's standpoint, but it also discusses cryogenic requirements. The treatments of high-temperature superconductivity are of greater depth than those in the other two texts. My only criticism is the typesetting: Because the book is printed from camera-ready pages, the type styles change from chapter to chapter.

If you can only choose one book, Weinstock and Nissenoff's *Superconducting Electronics* is clearly the best of the three. If your interests are focused on the high frequencies, then Hinken's *Superconductor Electronics* may be more appropriate to your needs. By bringing out three texts on superconducting electronics, Springer-Verlag has allowed the serious experimentalist to pick and choose according to his or her interests.

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A Shield in Space? Technology, Politics, and the Strategic Defense Initiative

Sanford Lakoff and
Herbert F. York
U. California P., Berkeley,
1989. 409 pp. \$37.50 hc ISBN
0-520-06650-2

It is somewhat remarkable that after the expenditure of well over 20 billion dollars and a controversial existence of some seven years, the Strategic Defensive Initiative has not been the subject of a comprehensive book. Sanford Lakoff and Herbert York have now filled that void with *A Shield in Space*, a thorough examination of the full spectrum of political and technical issues inherent in this program. There have been many monographs or collections that examined various aspects of SDI, or that advocated or condemned it, but none are as balanced or as complete in their presentations as this book. If there is a criticism, it would be that Lakoff and York's book is somewhat repetitive on some issues as a result of their multidimensional treatment.

The authors are eminently qualified for their task. Lakoff is a professor of political science at the University of California, San Diego. York is director emeritus of the Institute on Global Conflict and Cooperation and a professor of physics at the University of San Diego. York also was the first

Director of the Lawrence Livermore National Laboratory as well as the first Director of Defense Research and Engineering in the Eisenhower and Kennedy Administrations.

A Shield in Space provides a good summary of the technical developments and political events over the last 20 years that are essential to any comprehensive discussion of SDI and its implications for the future. However, the major portion of the book is devoted to a discussion of the possible outcomes for SDI technology and of policy options for the US-USSR strategic relationship. Unfortunately, as with all books written in the last year or so, world events have moved much faster and farther than the imagination or daring of most authors. The result is that the political options considered by Lakoff and York appear limited in terms of the current world situation. The East-West relationship in Europe, which has driven much of our strategic policy through the concept of extended deterrence, is much different from the one they describe. As might be expected, their judgments in the technical areas are much closer to the mark.

Lakoff and York do a good job of presenting all sides in the SDI debates; there is no question of where their true sentiments lie. While they believe in carrying out an active research and development program on SDI technologies, they have little faith that the technical goals set out by President Reagan for the program will be met. Their main message is that "SDI is a classic example of misplaced faith in the promise of technological salvation. . . . To expect advances in technology to provide security, in and by themselves, is to ask more than they can possibly provide. . . . To adopt this illusory faith that technology alone can achieve national security is also to ignore the need to address the political sources of insecurity by diplomatic means."

One factor contributing to their view is the paradox they describe wherein "even if a robust shield is built, and even if it could be reasonably expected to work as advertised, critics will come forward with claims that it is unreliable and that the other costly activities needed to maintain the old-fashioned kind of deterrence must still be supported. The irony is that those who will find the flaws in even a robust strategic defense are apt to be the same researchers who are now urging the United States to proceed with SDI before the Soviets do it first. . . . A space shield, no matter how elaborate, cannot be pro-