

Landau and Vladimir Fok and the mathematician Nikolai Luzin.

The letters in this volume also throw light into some obscure corners of Kapitsa's career that have puzzled many in the West. Did Kapitsa return to the USSR of his own free will? His letter to Molotov of 7 May 1935 shows that he was, in fact, detained, as mentioned above. Did Kapitsa refuse to participate in the A-bomb project because he was a pacifist? No. According to his letter to Stalin of 25 November 1945 he chose not to participate because he did not have much confidence in the success of the enterprise and had had a run-in with Beria, the czar of Soviet nuclear research. Did Kapitsa participate in military-related research? Yes. As a letter to Georgi Malenkov dated 25 June 1950 attests, he developed one of the first blueprints of what we would now call a "Star Wars" system.

Kapitsa's loyalty to the regime gave him additional opportunities to try to reform it from within. In the last letter in this remarkable collection, written in 1980, Kapitsa wrote to Andropov, then head of the KGB, in defense of Soviet dissidents Andrei Sakharov and Yuri Orlov. "We achieved nothing applying growing administrative pressure to Sakharov and Orlov. [Sakharov had already been sent into exile in Gorki and Orlov was in jail.] Maybe it's better, plainly speaking, just to backpedal?" Thus Kapitsa was able to help the transition from Stalin's totalitarianism to Mikhail Gorbachev's *perestroika*: not a small accomplishment. Though incomplete (at least one letter to Stalin is missing), this remarkable collection certainly merits translation into English.

Letters to Mother: The Early Cambridge Period

P. L. Kapitsa (edited by D. Lockwood; translated by E. Lockwood)

National Research Council of Canada, Ottawa, 1989. 120 pp. \$10.50 pb ISBN 0-660-13099-8

Now that the political climate is changing in the Soviet Union, we can expect to learn a great deal about Soviet physics in the 20th century that has heretofore been obscure. High on the list of interesting topics is the career of Peter Kapitsa. Since the preceding review by Mark Kuchment outlines Kapitsa's career, it is unnecessary to repeat that material here. Like the book reviewed by Kuchment,

this is a collection of letters, but in this case they have been translated for us (by Eugenia Lockwood). The book reproduces the complete text of the letters from Kapitsa to his mother published in the Soviet magazine *Novy Mir* in 1986, and includes an introduction by Academician Yuli Khariton as well as many footnotes by Pavel E. Rubinin.

As editor David Lockwood's writes in his preface:

These letters make fascinating reading even today, more than six decades after they were written. They give a lively account of Cambridge life in the 1920s as seen by a young Russian visitor. They also indicate the difficulties, stress and loneliness he faced in coming to work in a foreign land, particularly after the devastating personal tragedy of losing his father, his young wife and two children just months before his arrival in Cambridge. They reveal [Ernest] Rutherford's immense influence on the young Kapitsa, whose Cavendish experience set the tone for his future research work and his attitude toward science, in general. Through these letters we also follow the evolution of a most rewarding and affectionate relationship between Kapitsa and Rutherford. The oft-mentioned nickname of 'Crocodile' given to Rutherford by Kapitsa first appears in this collection in the letter dated 25 October 1921 and is used extensively by Kapitsa thereafter. The meaning behind it has been variously interpreted as being due to Rutherford's loud voice or heavy tread, and references are often made in English experience to the crocodile in *Peter Pan* and in Russian experience to the crocodile poems by K. I. Chukovsky. In the tradition of Russian usage, however, the term 'crocodile' when applied to people conveys the connotation of awesomeness that certainly dominated the young Kapitsa's attitude to Rutherford during their initial encounters. The exact reason for Kapitsa's use of the term is difficult to ascertain, as he was quite equivocal about it. Kapitsa earned for himself the nickname 'Centaur,' which was as ambiguous as his own nickname for Rutherford.

Khariton's introduction, which traces Kapitsa's career through the period 1921-26, is itself a very interesting and useful document. The book also contains 11 photographs

portraying the apparatus and surroundings at the Cavendish Laboratory in the 1920s.

Physics at Cambridge had during that time reached a pinnacle that has seldom been achieved anywhere. Typical of Kapitsa's insights into British science is the following passage:

It was England, however, that produced the greatest physicists, and now I begin to understand why. The English school is exceedingly conducive to the development of individuality and provides infinite opportunities for self-expression. One of its main characteristics is the absence of routine and stereotype.... The second factor is the drive to obtain results. Rutherford is very concerned that a person would not work without seeing some results, for he knows that this may kill one's desire to work.

Several letters also describe the construction and testing of the large generator Kapitsa used to create high impulsive magnetic fields. The letters also reveal British society in the 1920s as seen from Cambridge University by a clever and sensitive Soviet citizen. Some of the letters describing social occasions are hilarious, in particular, the account of James Chadwick's wedding and Kapitsa's first airplane flight.

Anyone interested in the evolution of physics in the first half of this century would be well advised to read this small volume. It is scrupulously translated, annotated and edited—a permanent contribution to the history of physics.

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China Builds the Bomb

**John Wilson Lewis
and Xue Litai**

Stanford U. P., Stanford, Calif., 1988. 329 pp.

\$29.50 hc ISBN 0-8047-1452-5

With the publication of *China Builds the Bomb* by John Lewis and Xue Litai, we now have on record, in varying degrees of detail and authoritativeness, studies on each of the five acknowledged nuclear weapon states. The authors examine the why and the how of Chinese entry into the "nuclear club." By doing so they provide insight into the international and foreign policy considerations that motivated China's decision. They also reveal how a backward nation confronting enormous economic development problems and a lack of assets necessary to move a high-technology

program forward not only met that challenge but did so in a timely manner. Specialists on nuclear proliferation may draw from this book some interesting conclusions regarding China's motivation, although it is questionable whether lessons from the Chinese experience are easily generalized to embrace other potential entrants into the nuclear weapons club.

The authors focus on the role of perceived threat and nuclear blackmail by the United States to explain China's decision to engage in a nuclear weapons program. But it is arguable that even in the absence of such a perception, China, as one of the five permanent members of the Security Council of the United Nations, may have felt compelled for political reasons of status and prestige to enter the nuclear club. That, rather than perceived threat, surely was the principal motivating factor for both Great Britain and France in their quest to become nuclear powers.

Students of Chinese politics cannot help but profit from reading this book: They will gain an understanding of the role of the Party and how it interacted with the scientific and technological communities in bringing the nuclear weapons program to a successful conclusion. The book also offers a marvelous case study against which one can test the methods used by the Chinese leadership to invoke socioeconomic policies. In this case the Government avoided intrusiveness and micromanagement and left the scientific and technical decisions to the experts. This toleration of flexibility and deviation from preferred behavioral norms permitted the nation to meet so formidable a challenge. It is striking that the positive lessons of this experience were not to be repeated during the balance of the Mao regime.

For the specialist in Chinese political decision-making or in nuclear history, the book offers a wealth of detail. For the more general reader, it offers too much detail, especially with respect to internal developments such as the quest for uranium and the production of fissile material. The reader quickly gets lost in a forest of names and places, all of which distracts from the flow of the book.

A far more serious criticism, however, lies with the book's pretension to provide comparative analysis of nuclear history. The final chapter skims along some of the mountain peaks and picks out a few interesting and relevant comparisons, but for some unexplainable reason the authors completely ignore a long-standing

and rich literature on the French nuclear program which is perhaps the one against which the most interesting comparisons might be drawn. That literature includes this reviewer's *Atomic Energy Policy in France Under the Fourth Republic* (Princeton U. P., 1965), which is widely cited by those who study nuclear proliferation, the interaction between the political and scientific communities in national decision-making and French politics. That body of writing also

includes two books written by a key participant in the French nuclear program from its inception until the early 1980s, Bertrand Goldschmidt. His book *L'Aventure Atomique* (Fayard, Paris, 1962) would have been a most interesting counterpoint for the early development of the Chinese program, and his *Les Rivalités Atomiques* (Fayard, Paris, 1967) would have been most useful in examining perceptions about prestige and status and their implications for the devel-

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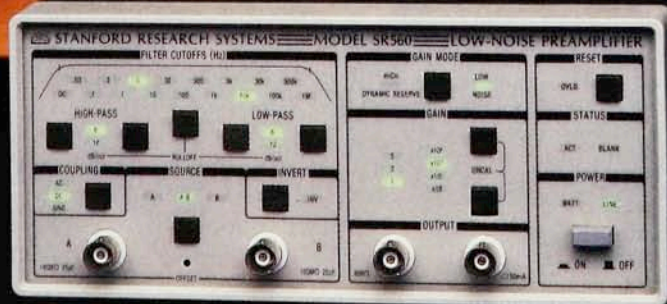
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opment of the French program. Instead, amazingly, the authors include Germany in the list of "atomic weapons programs" that this book is intended to complement. The inclusion of Germany and the exclusion of France in such a list makes no sense and detracts from the comparative value this book might otherwise have offered.

LAWRENCE SCHEINMAN
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An Introduction to Millikelvin Technology

David S. Betts
Cambridge U. P., New York,
1989. 102 pp. \$39.50 hc
ISBN 0-521-34456

The new text by David Betts, *An Introduction to Millikelvin Technology*, provides the reader with a concise description of the physical principles

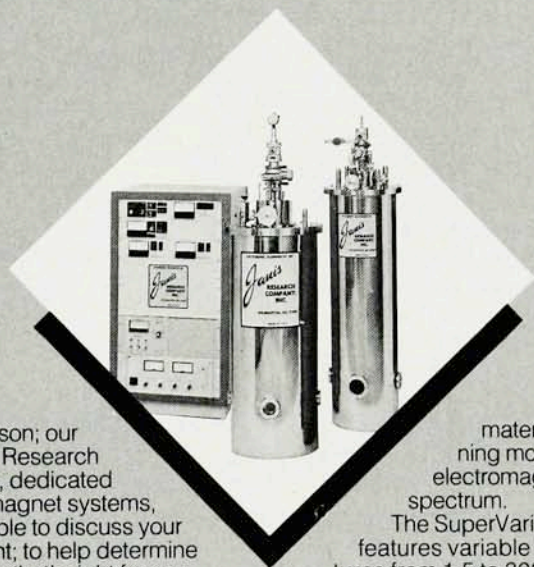
governing refrigeration and thermometry techniques useful below 300 mK. It is a relatively short book, containing just 102 pages of text, index and references. It includes none of the tables, charts and recipes of physical quantities and procedures that have made other books on the subject useful references for serious low-temperature physicists. On the other hand, Betts has produced a lucid description of how—and how well—various cooling schemes work and what physical constraints govern the design of useful devices. He makes frequent reference to published manuscripts and books on each subject to steer the interested reader to more detailed sources of information.

This book will serve well as a text for an advanced undergraduate (or perhaps graduate) course on experimental techniques, as a means of orientation for a nonexpert who intends to use ultra-low-temperature equipment or as an introduction for a graduate student embarking on a career in experimental low-temperature physics. It is not, however, a comprehensive volume for those wishing to design an ultra-low-temperature refrigerator. Betts includes in his volume much of the description of the principles of low-temperature technology described in the now expensive text *Experimental Principles and Methods Below 1K* by Olli Lounasmaa (Academic, London, 1974) without discussing the methods. Ideally, Betts's text would serve as a wonderful introduction to the more technical, recently published volume *Experimental Techniques in Condensed Matter Physics at Low Temperatures* by Bob Richardson and Eric Smith (Addison-Wesley, New York, 1988). That text deals heavily with the more practical aspects of how to build low-temperature devices and even tells where to get the basic components.

Betts's description of the principles underlying most of the techniques he covers is concise and generally quite thorough. This text will therefore prove most useful for those interested in a serious understanding of the physics governing ultra-low-temperature devices. Betts provides equations useful for modeling refrigeration devices over a considerable temperature interval, and he clearly presents the advantages and disadvantages of competing technologies. The chapter covering thermometry, in which nine separate techniques are described in just 15 pages, is a notable exception.

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