

sense of humility, a spiritual good that also makes for creative science.

SIDNEY PERKOWITZ  
Emory University  
Atlanta, Georgia

## Stopping the Spread of Nuclear Weapons: The Past and the Prospects

**D. Fischer**

*Routledge, New York, 1992.*  
336 pp. \$79.50 hc  
ISBN 0-415-00481-0

David Fischer is one of the elders of the nuclear nonproliferation community and was present at the creation of many of its successes and failures. He helped draft the statutes of the International Atomic Energy Agency and has spent 25 years helping to develop its policies. His book is strongest when he reviews, comments on and puts into perspective these experiences. It is not as strong when he analyzes the prospects for stopping the spread.

Nuclear proliferation and nonproliferation policy have replaced the US-Soviet nuclear arms race as the topic of choice in the nuclear arms field. Commentators fall into two almost distinct categories: those who discuss the supply of nuclear weapons material and the regime needed to curtail that supply, and those who trace the demand for nuclear weapons and the political drives behind this demand.

The former (who include most technical commentators) focus on what inspections have revealed and might reveal in countries of current concern and on steps that are needed to tighten the nuclear supply restrictions. The latter (who include most political scientists in print to date) focus on what the weakening or death of alliances on both sides of the former Iron Curtain might mean for their various participants and which countries perceive themselves as newly isolated—in short, the perceived security incentives (whether justified or not in the eyes of the nuclear “haves”) that might underlie a demand for nuclear weapons.

Fischer is knowledgeable on the supply situation. Starting with President Eisenhower's Atoms for Peace program and its ambiguous impact, he recounts the road to the present regime and its relative success in containing the spread of nuclear weapons. He knows where many of the bodies are buried on that

road and spares no one, certainly not the US, in discussing the inconsistencies and double standards that inevitably attended the policies of the Non Proliferation Treaty signatories regarding the spread of nuclear weapons to particular nations. He gives the perspective of the international establishment on these matters, enlivened with the wit and wisdom of an independent-minded, longtime participant.

The book contains little about demand and the internal debates in many of the countries of interest, such as Argentina, Brazil, India, Taiwan and the two Koreas. The recent reservations of the Japanese government about an indefinite extension of the NPT without progress on disarmament are not foreshadowed, although they echo what Japan, Germany and Italy said when the treaty was negotiated the first time around and the issue of the treaty's duration came up.

The book does not refer to events past 1991. Events these days have a way of dating all perspectives. Understandably, the book does not foreshadow the breakup of the Soviet Union and the consequent nuclear concerns pertaining to Ukraine and others. The book is at its most useful in reminding us of what has gone on in the world following the signing of the Non Proliferation Treaty. With the treaty's 1995 extension conference less than two years away, we need to remember this history, some of which is likely to be repeated in the months to come. The book's critiques of US policy in chapter 3 are especially useful. Fischer gives a good short list of what our government should do between now and then. The 60 plus pages of notes are at least as interesting as the text proper. The book is a useful, well-documented addition to any library on nuclear proliferation.

MICHAEL MAY  
*Stanford University*

## Radiation and Cloud Processes in the Atmosphere

**K. N. Liou**

*Oxford U. P., New York, 1992.*  
487 pp. \$85.00 hc  
ISBN 0-19-504910-1

One of the greatest uncertainties in modeling the Earth's climate is how to treat the effects of clouds on the rest of the system. So many interactions are possible that even small

changes in cloud properties are likely to affect the system's response to enhanced greenhouse effects or other perturbations. Kuo-Nan Liou's book on radiation and cloud processes makes a timely contribution to a subject that is central to current physical climate models.

The book covers a wide range of cloud interactions. The microphysical structure of clouds affects both precipitation processes and atmospheric radiation, directly impacting atmospheric thermodynamics and remote sensing. This structure is determined by the interactions of water vapor with atmospheric aerosols; the interactions in turn are governed by the flow of atmospheric dynamics. Cloud water and ice contents also have a complex dependence on temperature. All of this makes for a tantalizing mixture of nonlinear feedback possibilities, most of which have yet to be properly understood.

There are so many components to this problem that a uniformly authoritative treatment may indeed be beyond a single author. Liou nonetheless recognizes the “need to integrate radiative transfer and cloud physics . . . and to bridge the gaps between cloud-radiation and dynamical processes”; there is little he shies away from. This has yielded an admirably broad compendium of information, but with varying levels of insight and discussion. Liou's treatment is extremely thorough when he is on home ground, as in discussing the delta-four stream solution to shortwave radiative transfer or the radiative properties of ice crystals. In other areas—for example, when he discusses a Hadley circulation at the poles with “airflow in the upper level towards the equator,” or when he interprets the statistical correlation between increased high cloud and higher surface temperature at the same locale as an indication of direct cause and effect—the reader is left, at best, in a state of bemusement.

Despite the comprehensive nature of this book, which considers many of the important topics relating clouds and radiation, no mention is made of the radiative or other time constants needed to couple the different components together and determine the relative significance of climate feedback loops. Neither is there any mention of internal cloud inhomogeneity, which is thought by some to have a significant effect on radiative transfer. Several topics that fall exclusively in the domain of radiation or of cloud physics are also included.

The final chapter, on the role of

## BOOKS

radiation and cloud processes in various atmospheric models, serves to bring together much of the earlier treatment and to underscore the significance of these processes to problems ranging from one-dimensional equilibrium studies of climate to three-dimensional general circulation studies of weather systems.

The book's style is largely mathematical, with over 1200 displayed equations. These equations are accurately presented and should make Liou's book a handy reference for researchers in this field. The variability in authoritative explanation and the relative lack of physical perspective in the text, however, will present some difficulty for newcomers who may find the substantial reference lists helpful.

ROGER DAVIES  
McGill University  
Montreal, Canada

## From c-Numbers to q-Numbers: The Classical Analogy in the History of Quantum Theory

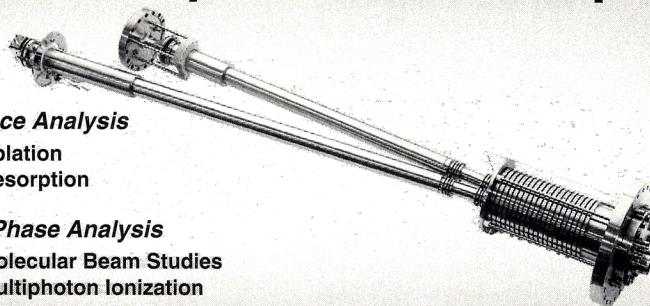
Olivier Darrigol  
U. Calif. P., Berkeley, Calif.,  
1992. 388 pp. \$60.00 hc  
ISBN 0-520-07822-5

Quantum mechanics is so removed from our classical intuition that to have arrived at it is a tour de force of the human intellect. The subject is currently introduced to students via the efficient wave mechanical route of Louis de Broglie and Erwin Schrödinger rather than the earlier, and in many ways more profound, matrix route of Niels Bohr, Werner Heisenberg and Paul Dirac. This superb book fills in a yawning lacuna in the education of most young students of physics (and probably a good number of their professors as well).

Starting with the early disputes between Ludwig Boltzmann and Max Planck, continuing through the confusions, competitions and debates between Arnold Sommerfeld and Bohr and the pioneering work of Hendrik Kramers and Heisenberg, and culminating with the youthful misstarts and ultimate triumph of Dirac, the book lays out the entire sweep of the development of matrix mechanics in considerable technical detail. I can think of no better way to gain a grasp of quantum mechanics than by reading this book. It is a treasure.

Unfortunately, precisely because

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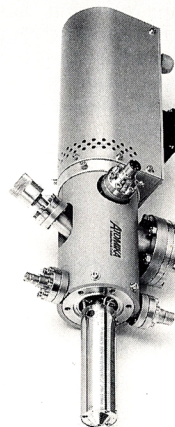
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