The End of the Cold War: Assessing the Pressures from Outside History's Mainstream

Unarmed Forces: The Transnational Movement to End the Cold War

Matthew Evangelista
Cornell U. Press, Ithaca, N.Y., 1999. 406 pp. $39.95 hc
ISBN 0-8014-3628-1

Reviewed by Herbert L. Abrams

That we survived this past half century without a massive nuclear exchange—between the former Soviet "evil empire" and the American "imperial hegemonists"—is a blessing for which we must all be thankful. How did we do it? Was it American restraint? Soviet fear? The wisdom of the leaders? Deterrence? Or was it nothing more than sheer luck?

An important ingredient of the conservative mythology distilled from the 1980s is that Ronald Reagan's "hard line" was the vital element in the collapse of the Soviet empire and the "winning" of the cold war. Running up a 3-trillion-dollar deficit in military spending and creating the specter of "Star Wars" were said to be part of a shrewd strategy designed to force the USSR into bankruptcy in its effort to compete militarily. Mikhail Gorbachev's "new thinking," then, was prompted by *Chapter 11*'s staring him in the face!

To interrupt this extravagant chain of thought: To suggest that Linus Pauling, Joseph Rotblat, or Andrei Sakharov, or the countless others who supported their effective opposition to the nuclear arms race, might have radically affected the policies of the USSR, if not of the US, is to court an accusation of revisionism and a distorted view of modern history.

To his credit, Matthew Evangelista, a professor of political science at Cornell University, has developed in *Unarmed Forces* a powerful argument that transnational movements of the past half century were able to influence the policies and decisions of a rigid, totalitarian USSR and a bureaucratized US foreign policy establishment. In both countries, the institutional framework was intuitively dismissive of the scientists as "amateurs" whose thrust for "peace" was at odds with reality and realism. Evangelista takes us in extraordinary detail through the evolution of Nikita Khrushchev's approach to the test ban and the ultimate signing of the treaty to ban atmospheric nuclear tests. He traces the advances in antiballistic missile research and development and the growing comprehension that defensive missile systems might heighten instability and intensify the nuclear arms race. A major subject of his historical analysis of the Leonid Brezhnev era is the mechanism whereby this understanding culminated in the antiballistic missile treaty of 1972. The final section of the book deals with the Gorbachev years and the radical changes in Soviet foreign policy that were initiated.

On both sides of the East–West divide, and bridging it, there were important networks outside government that contributed science- and humanitarian-based ideas and programs designed to control the arms race and reduce the threat of nuclear war. Consideration of their ideas was possible because of the credibility of the individuals and organizations, which won them an audience and a hearing, so as to translate ideas into action.

In each section of the book, the roles of such groups as the Pugwash movement, International Physicians for the Prevention of Nuclear War, Parliamentarians for Global Action, and others working transnationally are meticulously evaluated and compared with alternative explanations for significant developments. Evangelista carefully marshalls his arguments and provides a wealth of source material as an important dividend for the interested reader.

In a period when the complexity of society and government is such that individuals feel increasingly isolated from the decisions that will affect their lives and futures, it is helpful to be reminded that a small group of concerned and public-spirited citizens may affect the course of human history. The unilateral test moratorium declared by Gorbachev in July 1985, like his later proposal to eliminate nuclear weapons, at the meeting with Reagan at Reykjavik, Iceland, did not emerge from a vacuum. Nor did they reflect the Soviet defense and foreign ministries' creative thinking. Those Soviet positions were—at least in part—a product of the actions of a mix of individuals and international groups who were able to convey both their deep concerns and their pragmatic thinking at a period of extraordinary change in Soviet history. Evangelista has made a strong case for recognition of the depth and breadth of the contributions of these groups at a critical period and of the lessons to be learned from their intervention. Sometimes "unarmed forces" can make quite as much difference as state military power or diplomacy.

HERBERT L. ABRAMS *is a member-in-residence, Center for International Security and Cooperation, Stanford University, and a professor of radiology, Stanford University.*

Quantum Chaos: An Introduction

Hans-Jürgen Stöckmann
Cambridge U. Press, New York, 1999. 368 pp. $85.00 hc
ISBN 0-521-59284-4

Quantum chaos is the study of the quantum dynamics of systems that are classically chaotic. Contrary to the impression left by most textbooks, almost all conservative dynamical systems are at least partly chaotic in the range of their behavior. This applies to molecules, nuclei, quantum dots, acoustical systems, and dozens of other systems. The field of quantum chaos is still young, growing fast, and rich in conceptual, computational, and experimental challenges. The mathematical questions having a direct bearing on the field are as deep as you care to go, including the Riemann conjecture, convergence of trace formulas, and the intricacies of chaotic Hamiltonian dynamics.

People joining in the fun of studying quantum chaos seem to come from all over physics and chemistry; in the past, most had already established themselves in related fields before turning to quantum chaos. That is changing dramatically in Europe, where brilliant students attracted to the field's challenges are now moving directly into permanent positions. European institutions have discovered that quantum chaologists are fine mathematicians as well as numerical analysts, almost of necessity, and are remarkably broad in the range of applicability of their expertise. The field is coming of age.

Hans-Jürgen Stöckmann's *Quantum Chaos* appears as the culmination of remarkable accomplishments by perhaps several dozen key researchers, but most notably Michael Berry and Martin Gutzwiller, over the past 25 years. The maturity of the study of quantum chaos was recognized by the Nobel Foundation as recently as June 2000, when one of its Nobel Symposia was devoted to the subject.

Stöckmann's book is a remarkable work, reflecting the growth and excitement of the field and containing something for almost everyone interested in chaos theory and experiment. Experts will appreciate the historical tidbits, many of which are not well known, and will enjoy Stöckmann's compelling presentation of facets of the field that are outside their own areas of specialization. Beginners will find an engaging and approachable introduction to the field, with chapters on most aspects of quantum chaos and its experimental implications. The subjects are current and reflect a broad view, including experiments, inspired by chaos, whose ultimate bearing on the field may have been marginal but whose impacts on other fields can have been considerable.

The book contains the most readable introductions to random matrix theory and supersymmetry that I have seen. The style and clarity of writing are both excellent. Stöckmann is an experimentalist, but his insights and intuition for theory are quite remarkable and worth reading. References to original work are plentiful and well chosen, and for that reason alone the book is valuable and will fast become a "must-have" for those with an interest in quantum chaos.

On the downside, Stöckmann's book is not flawless. A few painful typos exist. For example, the first time the nearest-neighbor level-spacing distribution is displayed, it is missing a factor of the spacing, "s." More subtle but more serious is Stöckmann's treatment of symmetry in quantum mechanics, which is fast and loose at best and wrong at worst. Teaching from this section would be a rocky experience. In fact, experts in a number of subfields will no doubt recognize flaws that they would want to correct.

The sum of all these flaws is not devastating by any means, but because of them Stöckmann's book just misses the mark on being a good textbook from which nonexpert instructors could teach. This is a shame: Courses on quantum chaos are a great way to introduce classical and quantum mechanics of current theoretical and experimental interest. But such courses are rare, partly because of lack of a good text. It wouldn't take much to fix this aspect of Stöckmann's book and make it such a text, and I look forward to a corrected edition. Experts could use the book as a text now, correcting a few things along the way.

Other books on quantum chaos—first generation texts from the early 1990s—include Martin Gutziller's work, *Chaos in Classical and Quantum Mechanics* (Springer-Verlag, 1990), centered on his famous trace formula, Linda E. Reichl's *The Transition to Chaos in Conservative Classical Systems* (Springer-Verlag, 1992), and Fritz Haake's *Quantum Signatures of Chaos* (Springer-Verlag, 1992). Reichl's work is a useful survey of the literature; Haake's work (due out in a new addition soon) is mainly for theorists and much more rigorous than Stöckmann's book. I am glad to own all four, but the book I show to students first is Stöckmann's.

Eric J. Heller
Harvard University
Cambridge, Massachusetts

The Distribution of the Galaxies: Gravitational Clustering in Cosmology

William C. Saslaw
Cambridge U. Press, New York, 2000. 508 pp. $100.00 hc
ISBN 0-521-39426-0

William C. Saslaw's *The Distribution of the Galaxies* is an excellent and useful book that is especially well suited to the needs of advanced undergraduates and beginning graduate students. Researchers, as well, should welcome its comprehensive and detailed discussion of a theoretical approach that does not figure prominently in other book-length accounts of what Edwin Hubble, in a famous series of lectures, called the realm of the nebulae. Saslaw, a pioneer in the application of thermodynamics and statistical mechanics to gravitational astrophysics, modestly but accurately describes the book as "really no more than an extended essay on aspects of galaxy clustering that I've found especially interesting."

The essay's main thesis is that galaxies can be thought of as particles of a gas that evolves through a series of quasi-equilibrium states. With this assumption, and with the gas's equation of state given by the cosmic energy equation, one can use standard methods in thermodynamics, statistical mechanics, and kinetic theory to predict functions that describe the distribution of galaxies in physical space and in velocity space. A straightforward application of thermodynamic fluctuation theory then gives the distribution of galaxy numbers in a volume of given magnitude. To predict the distribution of peculiar velocities, one needs an additional assumption: the value of the parameter "b" (mentioned below).

Roughly half the book is devoted to these and closely related theoretical matters and to discussions of computer simulations and observational evidence that bear directly on the predicted distribution functions. The book also contains a relatively brief but insightful discussion of theoretical and practical aspects of correlation functions.

Most students, and many of their mentors, pay little attention to the history of the problems they are trying to solve, assuming that it is of more interest to historians than to working scientists. In reality, nothing is more helpful to the novice scientist than a deep understanding of how his or her subject has evolved. One of the best things about the book under review is its opening 50-page history of efforts to describe and understand the spatial distribution of galaxies.

A further bonus is a cluster of five short chapters dealing with nontraditional mathematical techniques for describing nonuniform spatial distributions of points: percolation; minimal spanning trees; topology; and fractals, introduced by a brief discussion of the problem of distinguishing genuine patterns from optical illusions. Here the author's talent for clear, concise, and insightful exposition is on display. Equally impressive, and especially valuable for students, are his accounts of key ideas and results in thermodynamics, including phase transitions and kinetic theory. The author does not merely apply results from other branches of physics to the problem at hand, he either derives them from the ground up or explains their provenance in ways