

clusters had been found in the Large Magellanic Cloud. What we will not find is a feel for how astronomy is done, a sense of the excitement of discovery, or an appreciation of the people who have contributed to our knowledge and understanding of the universe. The book seems to be addressed to the uninformed reader who is solely interested in masses of astronomical facts. Such a reader, however, will find the level of many parts of the book difficult—Maffei presents concepts like $H\alpha$, magnetic-field strength (gauss) and spectral-line intensity without explanation.

The figures are all black and white and are the usual ones found in any astronomy text. One figure is surprising; it is obviously an older one that has not been updated, even though Maffei himself is reasonable for the discovery that requires a revision—The diagram of the local group on page 352 does not show the Maffei galaxies but only notes their position in the caption.

Maffei's idea for writing this book came from his feeling that the space program has made people aware of space and in need of an astronomical education. While he does note a few recent space missions (Viking, Uhuru, Pioneer, Mariner), he completely ignores many of the other missions, both operating and planned at the time of writing the book, that makes the space program an exciting scientific venture—HEAO, Voyager, Space Telescope, Pioneer-Venus, Copernicus (OAO-3).

The five appendices at the end of the book are a rather eclectic collection of subjects: determination of distances of the stars; discovery, nomenclature and distribution of variable stars; celestial atlases and catalogs; the Maffei galaxies, and life in the universe.

The book went through six editions in Italian between 1973 and 1977. Daniel J. K. O'Connell, formerly director of the Vatican Observatory, translated the last edition into English.

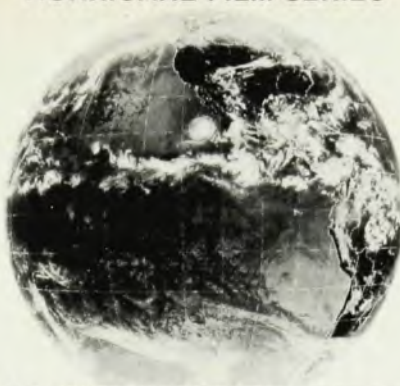
RICHARD C. HART
Space Science Board
Assembly of Mathematical and Physical
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National Research Council
Washington, D.C.

Nuclear Weapons and World Politics: Alternatives for the Future

D. C. Gompert, M. Mandelbaum, R. L. Garwin, J. H. Barton
370 pp., McGraw-Hill, New York, 1977.
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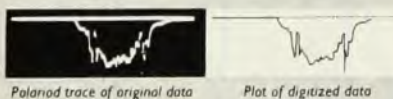
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powers emerge. These essays are a product of a 1980's project of the Council on Foreign Relations. The authors address the specific policy issues that in their judgment should form the nuclear agenda for the coming decade. In their thoughtful and sober essays they describe four possible nuclear regimes and the practicalities and difficulties that they see in achieving them.

What makes this book so timely is that we are today (November 1978) seemingly on the verge of completing the SALT II negotiations. If the current draft treaty is signed and ratified, the United States and the Soviet Union will have negotiated a treaty ensuring equal numerical limits on the numbers of strategic missile launchers and bombers. They will also have put additional limits on several subcategories of these systems (namely, the numbers of MIRVed ICBM launchers) and will have established an important precedent of limits on modernization of the ICBM forces (for example, only one new ICBM system and no modifications of external observables of existing missiles will be allowed). This treaty would be in effect into the mid-1980's, and provide the point of departure for further arms-control progress in the decade beyond.

The first nuclear regime, described by Michael Mandelbaum of Harvard, is the present one, in which deterrence has worked during the past decade and in which nuclear conflict has been avoided since 1945. Mandelbaum, whose field is government and national-security crises, argues that the nuclear weapons have fostered moderation and stability, and that as one looks ahead, stability depends more on the comparison of our nuclear arsenals than on what their owners say they will do with them. The three key elements of this regime that he identifies are mutual assured destruction, existence of vast arsenals of nuclear forces, and their approximate equality. He recognizes, however, that new problems for stability are emerging as a consequence of technological weapons advances outpacing diplomatic progress. These problems appear most notably in the present-day context in the emerging counterforce threat against the ICBMs in their hardened underground silos, due to the development of reliable and very accurate MIRVed ICBMs. In the face of these technological advances Mandelbaum argues, however, "the new weapons that scientists and engineers are designing are making, and are likely to continue to make, an increasingly faint imprint on the nuclear regime as a whole." He also believes that "the high force levels and the commitment to equality central to the regime make a continued arms race a far smaller threat to strategic stability than would be the case in, for example, the second nuclear regime in which force levels would be lower and could be extremely unequal." Furthermore, he as-

serts that prohibitions arresting the advance of technology for more sophisticated weapons would run counter to the spirit of science by restricting the liberty of inquiry, would not be enforceable, and would risk stifling innovations that could reinforce nuclear stability.

Each of these arguments is very convincingly answered in the essay on the second nuclear regime described by Richard Garwin, a Research Fellow at the Thomas Watson Research Center of IBM. Garwin, who has been a leading expert in defense science and weapons design for three decades, argues that it is of highest importance to *give greater emphasis to restraint* in the modernization of weapons and in their qualitative improvements, in order to preserve the stability of our present situation. A strong research and development effort can and should continue in the interest of avoiding technological surprise. At the same time, qualitative restraints on weapons technology can be implemented by verifiable restraints on the testing and evaluation of new systems. Garwin further emphasizes the importance of strong conventional, or nonnuclear, forces in providing alternatives to nuclear warfare. Garwin's essay is the one most directly relevant to the current agenda of arms-control possibilities facing us in the coming decade.

The third regime, described by John Barton, a professor at the Stanford Law School and also an arms-control expert, complements the other studies, and looks to the possibility of a *nonnuclear* world emerging over several decades. This is a more speculative and more visionary subject because it is further from today's situation, but Barton raises important questions of how to begin trying to make the transition from today's world to one in which nuclear weapons are proscribed. He also analyzes the special difficulties and instabilities caused by uncertainties when the nuclear arsenals are reduced to very low levels. He describes different political models for dealing with these problems. To varying degrees they call for a transfer of citizen loyalties from national to international governments in a regime that he describes as a "vision of a feasible alternative" to today's world.

Finally, David Gompert, currently director of the Office of International Security Policy, US State Department, describes a fourth regime. In it he foresees that, in the coming 10-15 years, deterioration of the stability that we now "enjoy" in the first regime is more likely than major progress toward nuclear disarmament. He describes how such strategic deterioration would result due to proliferation, improved first-strike capabilities, and/or significantly superior capabilities in the hands of one of the two superpowers. Emphasizing the importance of "managing" the world order to guide it in a stable strategic condition, Gompert properly identifies as a crucial question in

the quest for crisis stability "whether superpower X compensates for improved war-fighting capabilities of superpower Y by strengthening the invulnerability of its own retaliatory force or imitates the counterforce and defense emphasis of Y."

This book is a valuable introduction for those seeking a better understanding of the crucial arms-control issues facing us, and of the political problems of trying to shape a stable nuclear future along one of four directions that are mapped out. It is also an excellent text for students of these problems because the authors have asked, with clarity and sobering restraint, the hard questions and sought to provide some answers.

SIDNEY D. DRELL

Stanford Linear Accelerator Center

Stanford University

Stanford, California

Atomic Nuclei and their Particles

E. J. Burge

193 pp. Clarendon (Oxford U.P.), New York, 1977. \$13.95

Atomic Nuclei and their Particles is an introductory text intended for first- or second-year undergraduates. It is the thirteenth volume in an integrated series—the Oxford Physics Series—covering elementary through advanced material in a reasonably priced format. In the present text, in roughly 200 pages, E. J. Burge discusses the particles of nuclear physics, ranging from the pre-Rutherford era of electrons, atoms and photons, through the hadrons up to the recent era of the psions. Along the way, he treats, in an offhand, conversational way, nuclear accelerators, nuclear instruments, nuclear reactions, forces and models, cosmic rays, and elementary particles. The level of the presentation is roughly that of *Scientific American*, but the presentation lacks the skillful simplicity and clarity of illustration in that journal.

It is not clear what degree course could make use of this text. Burge uses an historical, descriptive approach for much of the material (amply supplied with the familiar names and dates) and this material is easily accessible. For the more difficult material, he tosses off ideas and concepts at a rapid pace, but the explanations (though technically correct) cannot really be all that understandable to the intended audience. Burge has an unfortunate tendency to bring in new concepts without even an attempt at a definition of the words or symbols. This is particularly annoying for dimensional units, and the table at the back of the book makes matters worse (confusing, as an example, F for the Faraday (charge) with F for farad (capacitance)). Similar

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