

Defusing Armageddon

Inside NEST, America's Secret Nuclear Bomb Squad

Jeffrey T. Richelson

W. W. Norton, New York, 2009.

\$27.95 (318 pp.).

ISBN 978-0-393-06515-2



Largely unheard of until the early 1990s, the US's Nuclear Emergency Support (originally Search) Team was commissioned to search for and defuse covert nuclear explosives and bombs that spread radioactive materials. The shadowy organization known as NEST was created in 1974 under US Department of Energy auspices because of concerns over possible covert nuclear attacks by the Soviet Union or China. It had primary responsibility for assessing the risks associated with such nuclear threats as extortion, hoaxes, accidents, and covert attacks; searching for the materials involved; and defusing any weapons that were found. Beginning in the early 1980s, and certainly after 9/11, NEST's focus shifted to nuclear terrorism.

In *Defusing Armageddon: Inside NEST, America's Secret Nuclear Bomb Squad*, Jeffrey Richelson presents a detailed account of the organization. His book is rich with historical examples of NEST's activities, which make very interesting reading. For example, he details the search for lost nuclear weapons after a US Air Force B-52 bomber collided with its refueling tanker near Palomares, Spain, in 1966; the search for radioactive debris from a Russian satellite that reentered Earth's atmosphere over Canada in 1978; and David Dales's extortion attempt in 1979 against a low-enriched uranium facility operated by General Electric Co.

However, Richelson's chronicle leaves the reader to wonder if it was meant to be exhaustive, or merely illustrative of past NEST activities. Although the book contains some anecdotes with detailed accounts (including unnecessary information like the physical dimensions of aircraft used by NEST teams), it provides little information on, for example, why NEST succeeded in a particular incident; nor does it draw from those historical examples lessons that could be applied to

improve NEST's effectiveness. Even when discussing recent NEST exercises, the text offers no clear lessons—apart from highlighting the perennial lack of interagency coordination in the federal government. Admittedly, that shortcoming is not entirely Richelson's fault, because NEST's technical and operational details, especially those a physicist might like to know, remain classified for good reason.

Perhaps a greater shortcoming of the book is that it does not establish for the reader a coherent framework within which to assess the importance of NEST activities. Such a framework would include an assessment of the likelihood of different types of nuclear-related terrorist or criminal acts, the consequences associated with each type of threat, and a discussion of the various means by which states, together with NEST, can either prevent or protect themselves from such threats in a cost-effective manner. Each of those issues is discussed in various places throughout the text, but Richelson's approach is anecdotal. For example, he notes the debate over how easy it would be for a terrorist group to acquire and successfully detonate an improvised nuclear device (IND). Some experts think that threat is vanishingly small; others believe such an occurrence is more likely than not in the decade ahead. Richelson, however, does not provide his own analysis to help the reader understand the assumptions on which the contending views rest and assess the arguments.

Clearly, Richelson knows that INDs and radioactive dispersal devices (RDDs; bombs designed to spread radiation) have vastly different consequences: The former can kill tens of thousands of people instantly; the latter would cause cancer in several tens or hundreds of people over a period of many years and few immediate deaths. But Richelson's frequent discussion of the two devices together blurs important distinctions between their consequences, their likelihood, and the best way to cope with each threat. For example, public education could mitigate the fear associated with an RDD attack but not an IND attack.

The book also discusses efforts to prevent the proliferation of fissile material, which, although not a NEST activity, is a top priority for nations seeking to prevent terrorist INDs. The US has engaged in such activities as helping to secure Russian nuclear warheads and materials, converting research reactors worldwide from highly enriched to low-enriched uranium, and conducting

covert operations such as Operation Sapphire, which quietly removed 600 kg of highly enriched uranium from a poorly guarded facility in Kazakhstan. Richelson does a good job of highlighting the diversity of fissile material and radioactive sources, but again, does not provide further analysis. Readers may be left with the impression that all paths to nuclear proliferation—for example, stolen Russian fissile material, a poorly protected Pakistani nuclear arsenal, and North Korea's willingness to sell nuclear weapons to anyone who can pay—are of equal concern. Also, the book notes developments in muon tomography and other fissile-material-detection technologies, but physicists will have to go elsewhere to find out how they work or whether they hold promise.

In summary, *Defusing Armageddon* is descriptive but not sufficiently analytical or technical. Those curious about the larger issues of the likelihood of nuclear terrorism and how best to cope with that threat may be left unsatisfied. However, the historical anecdotes are engaging, and readers interested in the details of NEST will have few other places to turn.

Dean Wilkening
Stanford University
Stanford, California

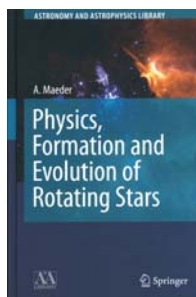
Physics, Formation and Evolution of Rotating Stars

A. Maeder

Springer, New York, 2008. \$159.00 (829 pp.). ISBN 978-3-540-76948-4

All stars rotate. For the Sun, rotation is so leisurely that the centripetal acceleration at the solar equator is less than 1% of its local gravity. Nevertheless, stellar rotation is important and interesting. For example, the rotation of the Sun, in combination with the upwelling of gas due to thermal convection, creates its magnetic field. Erupting from the surface, that field flings plasma into space as the familiar solar wind. The magnetized outflow carries off angular momentum and tamps down the star's surface rotation.

Those and many related stellar phenomena are understood to varying degrees but remain challenging problems. So, too, is the task of presenting all such material in a single volume. André Maeder, an astrophysicist at the Observatory of Geneva, has taken up that challenge. In *Physics, Formation and Evolution of Rotating Stars*, he not only



treats stellar rotation, but weaves it into the broader tapestry of stellar structure. There are already many books on the physics of stars, but as Maeder notes in his preface, they too often treat rotation as a minor side effect. He has

sought to remedy that oversight with a comprehensive work for graduate students and researchers.

Maeder's book is substantial and technical, as would be expected from a prolific theorist who has devoted decades to his subject—he authored or coauthored some 70 of the 640 references cited in the back. The book covers a broad range of topics associated with rotation and contains something to pique the interest of just about any theoretically inclined reader. Magnetic dynamos, meridional circulation, rotational instabilities—all those topics and more are included. The book also contains numerous high-quality figures that illustrate physical arguments and display computational results.

Yet the work as a whole is less than the sum of its parts. Ironically, given its title and the author's explicit goal of focusing on stellar rotation, the book is too diffuse. Of the 29 chapters, 14 are designated as basic treatments, best suited for an introductory course. But 11 of those do not mention stellar rotation at all; instead, they address general aspects of structure and evolution. Only at the ends of the other three chapters is stellar rotation mentioned. Anyone using those "introductory" chapters as the basis for a course would find rotation discussed in a strictly tangential manner—exactly the problem Maeder sought to remedy.

Maeder's expertise as a theorist is evident, and many theories discussed in the book are fascinating in themselves. After all, there is a reason why Bernhard Riemann, Henri Poincaré, and numerous others have visited the realm of rotating, self-gravitating bodies. But anyone traversing the dense forest of derivations and plots in Maeder's book may easily lose sight of their purpose, which is to explain real objects in space.

That disconnect between theory and reality is evident in part 5 of the book, which discusses early stellar evolution. For example, figure 20.2 (page 517) shows theoretical evolutionary tracks for pre-main-sequence stars whose masses range from 0.8 to 60 times the solar value $M_{\odot}$. Although those tracks

embody some interesting physics, no one has ever observed a 60- $M_{\odot}$ pre-main-sequence star. The most massive known ones, those of the Herbig Be class, only reach about 10 $M_{\odot}$. The reason is that more-massive objects contract so fast that they ignite their hydrogen and thereby join the main sequence while still accumulating material from surrounding interstellar gas.

The book is strongest when it deals exclusively with rotational issues. Maeder's inclusion of key results from helioseismology in his chapter on non-radial pulsations is especially welcome; stellar astronomers need more such exposure to important findings from the solar community. However, even the rotational sections can be tough going—the point of many of them seems to be to develop equations rather than provide physical insight. The work's awkward English is an additional impediment. Readers will have to fend for themselves when encountering such descriptors as "the momentum of force S by volume unity" (page 339).

With its wealth of information, Maeder's book will be useful for those seriously interested in the internal dynamics of stars. Jean-Louis Tassoul's classic *Theory of Rotating Stars* (Princeton U. Press, 1979) is less ambitious in scope and, of course, lacks recent developments. However, it presents each physical idea in a more logically transparent and methodical fashion. For those seeking a unified introductory graduate text, I recommend the second edition of *Stellar Interiors: Physical Principles, Structure, and Evolution* (Springer, 2004), by Carl Hansen, Steven Kawaler, and Virginia Trimble.

Steven Stahler

University of California
Berkeley

Geochemical Kinetics

Youxue Zhang
Princeton U. Press, Princeton, NJ,
2008. \$70.00 (631 pp.).
ISBN 978-0-691-12432-2

Geochemical kinetics is the study of the "when" and the "how fast" of geochemical processes. Some reactions naturally attain thermodynamic equilibrium. But for others, the minerals, glasses, and fluids involved react too slowly with each other to reach equilibrium over the broad temperature and pressure ranges found in the interiors and at the surfaces of rocky planetary bodies. Consequently, it is essential that geoscientists understand the



Save up to \$5000
Upgrade Your Michelson

Offer ends 9/30 North American Customers Only*

HighFinesse-Ångström Wavelength Meters

Accurate Like Your Research
Redefining Performance

- Most stable and reliable
- Pulsed & cw for 192 – 2250 nm
- Fastest measurement: 200 Hz
- Multichannel 1 to 8 lasers



A Passion for Precision.

Phone: (585) 657-6663
sales@toptica-usa.com
www.toptica.com
www.highfinesse.com