books

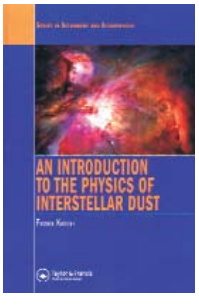
Clarifying the role of the universe's particulate matter

An Introduction to the Physics of Interstellar Dust

Endrik Krügel
Taylor & Francis, New York, 2008. $79.95 (387 pp.). ISBN 978-1-58488-707-2

Reviewed by Angela Speck

Interstellar dust used to be considered an annoyance. It dims and reddens visible light from distant objects, making some regions of the sky almost impossible to observe. But with the emergence of IR astronomy in the late 1960s, the importance of dust particles in the universe began to be revealed. Dust is a vital ingredient in understanding many astrophysical environments; it is essential in star formation and contributes to several aspects of interstellar processes such as gas heating and the formation of molecules. In addition, mass loss from evolved stars is radiation driven and thus intimately linked to the precise nature of the circumstellar dust, which affects the coupling between stellar radiation and circumstellar material.



Dust needs to be well understood in its own right if we are to comprehend how it influences many aspects of astrophysics. To educate students in the delights and pitfalls of cosmic dust, many astronomy and astrophysics departments offer courses, either at the advanced-undergraduate or graduate level, on the interstellar medium (ISM).

Angela Speck is an associate professor of physics in the department of physics and astronomy at the University of Missouri–Columbia. She is an IR astronomer whose interests include stellar evolution, astromineralogy and dust around evolved stars, galactic chemical evolution, meteoritics, and the optical properties of materials.

Endrik Krügel's *An Introduction to the Physics of Interstellar Dust* offers the perfect foundation for studying dust in the ISM and the physics of interactions of dust with light, as well as with its surroundings.

Krügel, a researcher at the Max Planck Institute for Radio Astronomy in Bonn, Germany, has taken his previous encyclopedic tome, *The Physics of Interstellar Dust* (Institute of Physics, 2003), and produced a slimmer volume that still covers the foundations. Krügel's new book is designed for advanced-undergraduate and graduate courses and is tremendously appealing because it requires no prior knowledge of astronomy. It can be used as a textbook, a self-study guide for graduate students or more senior academics, or a general reference for active researchers to delve into as needed.

A major problem in investigating cosmic dust is that a proper study incorporates so many aspects of the physical sciences, and current texts rarely bring those topics together in such a coherent and concise form as Krügel does. He starts with undergraduate-level electricity and magnetism and builds up to a complete picture of how we understand dust in space merely by observing light. Krügel starts at a level that is accessible, but he does not oversimplify. He moves from scattering and absorption by a single particle to the importance of radiative transfer modeling for a collection of particles and on to the effect of dust on hydrodynamics. The book does not attempt to address all aspects of the interaction of cosmic dust with space and, particularly, magnetohydrodynamic interactions. But it provides the tools that a student, or researcher whose main expertise lies elsewhere in astrophysics, will need to further his or her studies and delve into more specialized texts.

The book does fall down in a few places. First, the sources of dust injected into the ISM, especially the asymptotic giant-branch stars and planetary nebulae, are given short shrift. That approach is to some extent necessary to keep the book concise; however, the treatment of pre-solar grains is woefully inadequate. The mere existence of pre-solar grains shows that some stardust survives not only the traverse of the ISM but also the process of star and planet formation. The short subsection on the topic is out of date and fails to give the reader a true picture of the importance and results of the study of those grains. Furthermore, it suggests that those grains are processed in the ISM, which is misleading. Second, and a more minor issue, is the shoddy editing. It is a shame that such a valuable resource is marred by numerous, avoidable spelling mistakes and typographical errors. Third, students and researchers who are comfortable with the physics side of cosmic-dust studies but who want to learn more about the geological, mineralogical, and chemical aspects of dust will be disappointed.

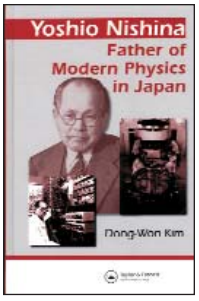
That last point is not meant to be a serious criticism of Krügel's book, which cannot be all things to all people. However, the book's goal is to bring together the various aspects of physical science needed to understand dust in space. And researchers in the field who want to fully understand the processes involved in determining the nature of dust in astrophysical environments need to know many aspects of geology and chemistry in addition to the physics. *An Introduction to the Physics of Interstellar Dust* would be the perfect companion to Charles Cowley's *An Introduction to Cosmochemistry* (Cambridge University Press, 1995), which treats the geology and chemistry of cosmic-dust studies. But Cowley's book lacks the detailed physics presented in Krügel's latest text.

Yoshio Nishina

Father of Modern Physics in Japan

Dong-Won Kim
Taylor & Francis, New York, 2007. $69.95 (195 pp.). ISBN 978-0-7503-0755-0

The history of physics in Japan might be one of the most important under-



studied subjects in the history of science. Japan is a major player in contemporary physics, and the transmission of modern physics into the country might provide a key to understanding the globalization of Western science. Yoshio Nishina (1890–1951) is a relatively unknown but significant Japanese physicist who was instrumental in transforming the Japanese physics community into an active, internationally competitive group. Dong-Won Kim's *Yoshio Nishina: Father of Modern Physics in Japan* gives a compact account of Nishina's life. It is successful as introductory reading for the general public, but not so much as a serious scholarly contribution to the literature.

Kim is an independent scholar who retired from the Korean Advanced Institute for Science and Technology and is now a visiting professor in the department of science and technology at the Johns Hopkins University. His book seems not to be intended as a scholarly monograph. It relies heavily on secondary literature but contains little explanation of his position on whether he agrees with the preceding works on the subject. In the introduction, Kim states that his "appreciation of [Nishina's] greatness is based on ideas and opinions that are not necessarily those expressed in traditional Japanese scholarship, particularly in areas on how and why Nishina's role and contributions were critical to the development of the Japanese physics community." What he means by "traditional Japanese scholarship" baffles me. In any event, Kim overrates his own contribution if he claims novelty in discovering that Nishina's "greatness" lies in how the scientist contributed to the development of the Japanese physics community. Nishina's importance in this regard has been more a matter of common sense among those who have written about him ever since physicist Sin-itiro Tomonaga. Moreover, despite Kim's critique of his Japanese colleagues, a considerable proportion of the book depends on works by Japanese scholars. His direct citation of primary sources already covered in the secondary works, however, blurs his scholarly dependence on the secondary literature. For example, section 2 of chapter 1 seems to rely totally on my own 2002 dissertation; but in most footnotes, Kim cites primary sources without mentioning they have been cited and discussed in my thesis.

Kim's book also expresses unacceptably stereotypical views on Japanese and other East Asian cultures. Kim states, "In East Asia, such celebrated figures as Nishina traditionally are depicted as 'perfect' men. . . . Criticism of heroes, particularly great *sensei*, is not permitted." But that is not the case in Japan, where even Nishina's students did not always depict him as perfect. Soon after Nishina's death, in a 1951 journal article devoted to him, Tomonaga likened Nishina to a mountebank entrepreneur. He recalled that when some of Nishina's students saw an advertisement by a quack doctor for electronic treatment, they joked that it was something Nishina would do.

Kim writes that "[Nishina] was typically Japanese. He had been a model student from elementary school to university. . . . He had behaved exactly as the typical Japanese did when he met and dealt with senior Japanese scientists or nonscientists outside his laboratory." Kim, however, does not explain what, exactly, "typical" means and how being typical led to Nishina's success. Kim asks "How much did being Japanese influence Nishina's scientific work and contribute to his success?" Such cultural essentialism, assuming "typical" Japanese behavior, should no longer appear in academic literature, especially after the intense critique of *Nihonjinron*, the theory of "Japaneseness," in Japanese studies in North America.

The book's reliance on disproportionately English-language sources further undermines its value. For example, in the discussion of the Japanese research institute, RIKEN, Kim cites Tessa Morris-Suzuki's tertiary work in English rather than Satoshi Saito's secondary work in Japanese, which Morris-Suzuki cites. Also in the introduction, Kim claims that theoretical physicist Hideki Yukawa and Tomonaga often called Nishina "Professor Nishina" in their memoirs even though he never was one, because the prefix of "professor" in Japanese conveys respect and authority. That misconception probably originates from Kim's reliance on English translations, in which *sensei* is often mistranslated as "professor," as in Tomonaga's *The Story of Spin* (University of Chicago Press, 1998).

Even when Kim uses primary sources, he interprets them inadequately. He quotes Tomonaga's recollection of his first encounter with Nishina: "Nishina looked far from the world-class scientist we imagined (we guessed a sharp looking figure). He looked mild and talked without any sharp remarks" (page 66). From that testimony, Kim concludes that Nishina's treatment of students was different from that of most Japanese university professors, who, Kim claims, were traditionally arrogant. But Tomonaga was talking about the contrast between the actual Nishina and his imagined Nishina, a razor-sharp international scientist trained in Europe, not a "traditional" Japanese professor. Apparently, Kim's projecting his preconception about Japanese professors, for which he provides no basis, has led to the misinterpretation.

With so few biographies of Japanese scientists available in English, *Yoshio Nishina* certainly contributes to the English-language, general interest literature on the history of non-Western science. But its contribution fails to be scholarly. I agree with Kim in hoping "that more extensive biographies of Nishina with fresh perspectives will appear in the near future."

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Elements of String Cosmology

Maurizio Gasperini
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One of the most important ongoing challenges in theoretical physics is to understand the nature of the Big Bang that started our universe. Albert Einstein's general theory of relativity, the best classical theory of gravity, predicts that the Big Bang is a singularity in which the density of matter and the curvature of spacetime both become infinite. General relativity, however, must break down before such singularities can form because quantum effects will become important. The physics near the Big Bang is thus a problem in quantum gravity.

String theory is the most actively studied approach to quantum gravity, and using it to try to determine the physics of the early universe is only natural. Maurizio Gasperini's *Elements of String Cosmology* is a good introduction to that active area of research. Gasperini, a professor of theoretical physics at the University of Bari in Italy, is a recognized expert in string cosmology and one of the inventors of the