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Introduction to special section: Electromagnetic scattering by nonspherical particles

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Qantitative interpretation of remote sensing measurements of aerosols, clouds, precipitation, and particulate surfaces requires accurate knowledge of the interaction of small particles with light and other electromagnetic radiation. Although many natural particles are known to have nonspherical shapes, the convenient availability and simplicity of Mie theory [*van de Hulst*, 1957; *Bohren and Huffman*, 1983] has led to a widespread practice of treating all particles as if they were spheres. However, this approach is rarely chosen after first studying the effect of nonsphericity and concluding that it is negligible. In fact, a vast amount of accumulated evidence suggests that scattering properties of nonspherical particles can differ both quantitatively and qualitatively from those of "equivalent" spheres, thereby significantly affecting the results of remote sensing retrievals.

The major objective of the Conference on Light Scattering by Nonspherical Particles: Theory, Measurements, and Applications, held September 29 to October 1, 1998 at the Goddard Institute for Space Studies in New York City, was to systematically summarize major developments in the field made possible by the rapid advancement of computers and experimental and numerical techniques over the past two decades. The conference attracted 115 registered participants from 18 countries and consisted of poster presentations and 12 oral sessions. The presentations were grouped on the basis of several topical categories and in each of these categories invited review talks highlighted and summarized specific active areas of research. All abstracts submitted had been reviewed by members of the Scientific Organizing Committee for technical merit and content, thereby ensuring a high-quality conference. Authors of regular and review presentations contributed to a volume of preprints published by the American Meteorological Society [*Mishchenko et al.*, 1998] and distributed to participants at the conference.

The conference covered the following major topics: numerical methods for computing the single and multiple scattering of electromagnetic radiation by nonspherical and heterogeneous particles, measurement approaches, knowledge of characteristic features in scattering patterns, retrieval and remote sensing techniques, nonspherical particle sizing, and various practical applications. Invited reviews summarized the following five research subjects: (1) basic relationships for scattering matrices (J. W. Hovenier); (2) major numerical techniques for computing electromagnetic scattering by nonspherical particles such as the separation of variables method for spheroids (I. R. Ciric and F. R. Cooray), the discrete dipole approximation (B. T. Draine), the superposition technique for compounded spheres (K. A. Fuller and D. W. Mackowski), and the *T*-matrix method (M. I. Mishchenko et al.); (3) the microwave analog technique (B. Å. S. Gustafson); (4) electromagnetic scattering by large spheroidal drops (P. L. Marston) and heterogeneous (P. Chýlek et al.), stochastically shaped (K. O. Muinonen), and Chebyshev (W. J. Wiscombe) particles; and (5) various remote sensing and geophysical applications such as light scattering and radiative transfer in cirrus clouds (K.-N. Liou et al.), the lidar depolarization technique for cloud and aerosol research (K. Sassen), radar scattering by hydrometeors (K. Aydin), microwave scattering by precipitation (J. L. Haferman), and scattering by interplanetary dust particles (K. Lumme).

The organizing committee of the conference solicited high-quality papers for a special section of the *Journal of Geophysical Research (JGR) on Climate and Physics of the Atmosphere*. This special section includes original research papers on remote sensing and geophysical applications of electromagnetic scattering by nonspherical particles as well as papers on theoretical and experimental techniques that find applications in geophysics. All papers have been subject to peer review and have been treated with the same scientific scrutiny as all manuscripts submitted to *JGR*.

In addition to the articles published in this special *JGR* section, other articles have been published in a special issue of the *Journal of Quantitative Spectroscopy and Radiative Transfer* [*Mishchenko et al.*, 1999a]. Invited reviews formed a monograph that has been published by Academic Press [*Mishchenko et al.*, 1999b]. We hope that these three publications will provide a comprehensive summary of the subject of electromagnetic scattering by nonspherical particles and its applications and an updated supplement to the book edited by *Schuerman* [1980] and the earlier special journal issues edited by *Shafai* [1991], *Barber et al.* [1994], *Hovenier* [1996], and *Lumme* [1998].

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organizing and running the sessions. We appreciate the sponsorship of the conference by the National Aeronautics and Space Administration (NASA), the American Meteorological Society (AMS), the American Geophysical Union, and the Optical Society of America. Financial support of the conference was provided by the NASA Radiation Science Program managed by Robert Curran. We thank the head of the Goddard Institute for Space Studies, James Hansen, and former members of the AMS Committee on Atmospheric Radiation, Thomas Charlock and Barbara Carlson, for their support. We appreciate valuable assistance from Carl Codan, Evelyn DeJesus-Quiles, Michael Diggs, Mary Larson, Carolyn Paurowski, Robert Schmunk, Nadia Zakharova, and many employees of Science Systems and Applications, Inc. The conference was convened by Michael I. Mishchenko and Larry D. Travis, NASA Goddard Institute for Space Studies, New York, and Joop W. Hovenier, Free University and University of Amsterdam, Amsterdam, The Netherlands. The Scientific Organizing Committee consisted of Petr Chýlek, Dalhousie University, Halifax, Canada; Bruce T. Draine, Princeton University, Princeton, N. J.; Kuo-Nan Liou, University of California at Los Angeles; Kenneth Sassen, University of Utah, Salt Lake City; Henk C. van de Hulst, University of Leiden, The Netherlands; and Warren J. Wiscombe, NASA Goddard Space Flight Center, Greenbelt, Md.

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