Light Scattering by Particles: Computational Methods

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by P. W. Barber & S. C. Hill

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LIGHT SCATTERING BY PARTICLES: COMPUTATIONAL METHODS

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Preface

This book presents the separation-of-variables and T-matrix methods of calculating the scattering of electromagnetic waves by particles. Analytical details and computer programs are provided for determining the scattering and absorption characteristics of the finite-thickness slab, infinite circular cylinder (normal incidence), general axisymmetric particle, and sphere. The methods and programs are applicable to electromagnetic wave scattering in general. However, the calculated results emphasize light scattering, e.g., the intensity is displayed rather than the electric field.

The computer programs are designed to generate data that is easy to graph and visualize, and test cases in the book illustrate the capabilities of the programs. The connection between the theory and the computer programs is reinforced by references in the computer programs to equations in the text. This cross-referencing will help the reader understand the computer programs, and, if necessary, modify them for other purposes.

The basic theoretical background as well as the documented and tested computer programs should be a useful reference for individuals who are new to the light scattering field as well as those with more experience. The book may also be useful as a supplement to a graduate level course.

While the computer programs have been tested for a variety of cases, it is not inconceivable that a particular program contains errors. Also, input parameters can be used which are outside the envelope of values for which results are computed accurately. Furthermore, especially with the T-matrix programs, it is possible to generate incorrect results if the convergence testing procedures are not carefully

followed. For these reasons, the authors and publisher disclaim all liability for any damages that may result from the use of the programs.

The programs are copyrighted, but each purchaser of this book is free to make copies of the source codes as required for their needs. We believe that the computer programs included with the book should be used in the same way as the text portion—only a single person should use them at any given time.

We acknowledge the contributions of former students Dau-Sing Y. Wang, Chun-Hong Chen, Pamela E. Geller, Barbara E. Messinger and Daniel S. Benincasa. Professor Milton Kerker of Clarkson University has nurtured our interest in light scattering and was among the first to appreciate the role that computer calculations can play in light scattering research. Professor Richard K. Chang of Yale University has provided continuous encouragement. The innovative experiments performed by him and his colleagues have been the primary motivation for developing many of the computer programs.

It would have been difficult to create this book without the $\text{\TeX}$ document preparation and typesetting system or the graphics programs developed by Golden Software, Inc. (Golden, Colorado). The entire manuscript was carefully typeset (using $\text{\TeX}$) and made camera-ready by Ms. Elizabeth Hernandez, to whom we are exceedingly grateful.

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