SIRIS

This page contains source code and documentation for SIRIS – Free Software for Light Scattering by Small Particles by Muinonen and Nousiainen (2003).

Siris is free software for the generation of sample Gaussian spheres and for the computation of light scattering by Gaussian particles and arbitrary polyhedral particles in the ray optics approximation. It is
available under the GNU General Public License that you can find on the World Wide Web (http://www.gnu.org/licenses/gpl.txt) and in the file Siris/GPL/gpl.txt.

Download **SIRIS package here** and Usage notes by Anne Virkki.

Installation

This package presently contains source codes of three models, named G-rayopt, P-rayopt, and G-sphere. G-rayopt is a Monte Carlo ray-tracing ray optics model for randomly oriented particles with a Gaussian random sphere geometry; P-rayopt is the same for randomly oriented polyhedral particles; G-sphere is for generating example realizations of Gaussian random spheres. The G-sphere is supplied also with example scripts to visualize the three-dimensional random shapes generated.

Each model is published under the Gnu General Public Licence (GPL). For more information about the license and distributing the package, please refer to the file license.dat located in the Siris/ directory. This file consists of the instructions on installing the software. The instructions are given for a Unix operating system. The programs probably work in other operating systems as well, but this has not been tested.

For information about testing and using the programs, please refer to the appropriate README files in the program subdirectories (G-rayopt/, P-rayopt/, and G-sphere/).

The package Siris.tar.gz is a gzipped tar file containing the source codes, some helpful scripts, and documentation. To install the software, first unzip the package by executing:

gunzip Siris.tar.gz

This produces a tar file Siris.tar which is unpacked by:

tar xvf Siris.tar

This creates a subdirectory Siris/ which contains the content of the package. (Alternatively, if you are using Gnu tar, the original Siris.tar.gz file can be unpacked simply by executing 'tar xzvf Siris.tar.gz').

First, go to the Siris/src/ subdirectory by executing:

cd Siris/src/

Executing 'ls' shows that there are three scripts: fgrayopt.run, fprayopt.run and fgsphere.run. These are simple shell scripts, handling the compilation of the G-rayopt, P-rayopt, and G-sphere, respectively. The scripts assume that you have a g77 Gnu Fortran compiler installed in your machine. If you prefer using another compiler, replace 'g77' in the scrips with the compiler of your choice. Each model is programmed with Fortran 77 and should be compilable with any compiler supporting Fortran 77. Since there are different editors for editing text files in unix, each with their speficic key bindings and functionality, no detailed instructions for editing the scripts are given. Once the scripts are edited to make use of the compiler of your choice, you can compile the models by simply executing:

./fgrayopt.run
,
./fprayopt.run

and

./fgsphere.run

Each script compiles the executable of the corresponding model and moves the executable into the corresponding program subdirectory under Siris/ directory, namely G-rayopt/, P-rayopt/, and G-sphere/. To access the subdirectory of the G-rayopt, execute:

cd ../G-rayopt/

Similarly, to access the subdirectory of the P-rayopt or G-sphere, execute:

cd ../P-rayopt/

or

cd ../G-sphere/

Now you are finished with the installation and can proceed to using the models. It is advised that you first test the executables by running them using the default input files and comparing the results with those provided with the package. The testing and usage of the each model is explained in the appropriate README file in G-rayopt/, P-rayopt/, and G-sphere/ subdirectories.

References

If using the SIRIS code and publishing results, please cite:
Muinonen, K., Nousiainen, T., Lindqvist, H., Muñoz, O., and Videen, G. (2009). Light scattering by Gaussian particles with internal inclusions and roughened surfaces using ray optics. Journal of Quantitative Spectroscopy and Radiative Transfer 110, 1628–1639.

Other references:
Muinonen, K., Nousiainen, T., Fast, P., Lumme, K., and Peltoniemi, J. I. (1996). Light scattering by Gaussian random particles: ray optics approximation. Journal of Quantitative Spectroscopy and Radiative Transfer 55, 577–601.

Muinonen, K. (1998). Introducing the Gaussian shape hypothesis for asteroids and comets. Astronomy and Astrophysics 332, 1087–1098.

Muinonen, K. (2000). Light scattering by stochastically shaped particles. In Light Scattering by Nonspherical Particles: Theory, Measurements, and Applications (M. I. Mishchenko, J. W. Hovenier, and L. D. Travis, Eds., Academic Press, San Diego), 323–352.

Muinonen, K. (2002). Light-scattering approximations for small irregular particles. In Electromagnetic and Light Scattering by Non-spherical Particles, Gainesville 2002 (B. Gustafson, L. Kolokolova, and G. Videen, eds., Army Research Laboratory, Adelphi, Maryland, U.S.A.), 219–222.

Nousiainen, T. (2002). Light scattering by nonspherical atmospheric particles. Ph.D. Thesis, University of Helsinki, Finland. (http://urn.fi/URN:ISBN:951-697-560-7)

Nousiainen, T., Muinonen, K., and Räisänen, P. (2003). Scattering of light by large Saharan dust particles in a modified ray-optics approximation. Journal of Geophysical Research 108, 4025.