Comets, exercise III

We are starting to get ready for the final task of the exercises…

The final goal:
(a) Create your own model particle for cometary dust.
(b) Compute light scattering properties (linear polarization as a function of phase/scattering angle, C_{ext}, C_{sca}, C_{abs} and asymmetry parameter g) for selected wavelengths from solar radiation spectra (0.25 – 2.5 µm) (see Fig. 1).
(c) Simulate the trajectory of your particle exiting from the nucleus with different speeds (1, 10 and 100 m/s)

Detailed tips for tasks (a)–(c):

(a) See exercise II, but note that we need wavelengths from solar spectra. Therefore you might need to revise the dipole size in your model, also perhaps the actual size. With the smallest wavelength λ=0.25 µm the dipole size needs to be about 0.0125–0.015 µm. If the particle is 64 dipoles per side, it means actual size of 0.8–0.96 µm.

If your particle consumes large number of dipoles with λ=0.25 µm you might want to do more coarse division to (larger) dipoles for larger wavelengths to speed up the computations.

You need to compute orientation-averaged scattering, but you can take quite modest number of orientation angles to save computing time. Example of orientation file 'avg_params1.dat' is on the course web page and it uses 4x7=28 'real' orientations and 31 scattering planes per orientation.

(b) For computing C_{sca} and g you need to remember to use option `-asym` with ADDA. Also compute radiation force with option `-Cpr_mat`. You will need to have the file '`alldir_params.dat`' from the webpage in the directory you are running ADDA.

(c) Simulate the trajectory of dust particle exiting from the nucleus. You can consider 2D problem where the only gravitational bodies are Sun and comet nucleus (at ~ 1 AU). The position of nucleus stays approximately constant during simulation time. The radiation pressure acts opposite direction from the Sun's gravitational force, so it can be considered as an adjustment for Sun's gravitation factor. More details will follow…

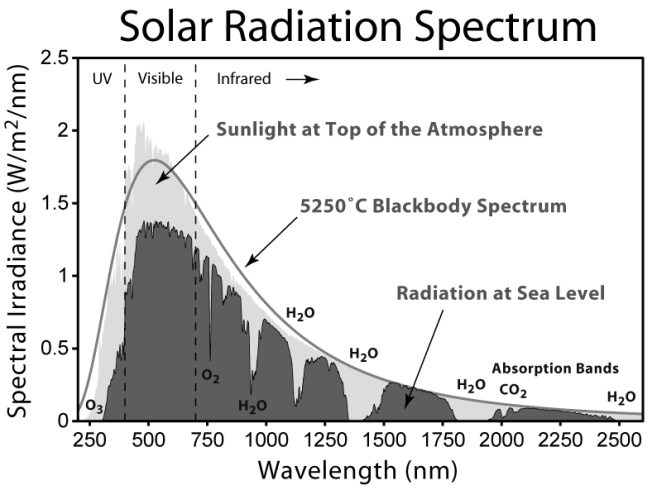

Figure 1.