Comets, exercise I

1. Get *adda* program and manual from http://wiki.helsinki.fi/display/PSR/Comets

2. Check that adda works – just try to run *adda* without any options. It should compute something and output some results.

3. Use *adda* to calculate scattering properties of some shapes that are built-in in *adda*, read and plot the results. Read *adda* manual for hints.

- Important sections in the manual: *Appendix A* for command line options, *6.4 Predefined shapes* for built-in scatterer shapes, *7.2 Orientation averaging* for random orientation computations, and *Appendix B.2 avg_params.dat* on the orientation averaging file format.

- Choose shape for your 'comet dust particle', box, sphere, ellipsoid, capsule, egg or cylinder. Cometary dust particles are most likely aggregates, but we will settle to these for now.

- Choose size (or sizes and in the end, average over sizes) for your particle. Choosing size involves choosing the wavelength, the actual size and the refractive index of your particle. There are some limitations that you should consider:
    - Size, wavelength and refractive index should be close to reality (see lectures)
    - On the other hand, the sequential version of *adda* (using no parallel computation resources) can handle perhaps about 2 000 000 dipoles, e.g. box with side length of 128 dipoles
    - …and the dipole size should be small so that the DDA works, see Eq. (1) in Sec. 4 in the manual

- You can specify the particle size in *adda* in many ways, one is to give the wavelength (option *-lambda*, in μm), size of the particle in dipoles along the x-axis (option *-grid*) and the dipole size by dipoles-per-lambda (option *-dpl*)

- Use orientation averaging (option *-orient avg filename*). The default file is *avg_params.dat*. Other useful options include *-dir* which specifies the output directory name and *-eps* for controlling the accuracy (can be set to e.g. 4 for faster computation)

- After you have managed to run your particle(s) with *adda*, read the results from file *mueller*. That file has the Mueller matrix elements for scattering angles from 0 to 180 degrees. Plot intensity (S11, preferably in log-scale) and linear polarization ratio (-100 % * S21/S11) as a function of the scattering angle. See if there are any typical features for cometary dust.

- If you have run several sizes (or refractive indices), average the Mueller matrix elements over them and plot again.