Collage 2020 : Homework 1

January 31, 2020

To respect your other out-of-class commitments, a flexible deadline for this homework is 03/01/2020. However, the sooner you get to it, the easier it will be.

Problem 1: Following the approach we did in the class, use time-dependent variations of the phase screen (file pscreen-512x512x100.fits), to calculate the image of the Sun, degraded by the atmosphere PSF for each these 100 time steps. The phase screens have been generated for a 1m x 1m aperture, so, in principle, you cannot use it for the telescope larger than 1m. Also, depending on the grid you use for your telescope aperture, you might want to interpolate the phase grid.

- Plot the variations of the image contrast with time.

- Compare them with the variations of the Fried parameter r_0 (file r0s.fits).

- Add all the images and calculate the image contrast in that case. Compare it with the contrasts of the individual images. Try to estimate, what would be the telescope aperture giving the same contrast.

Problem 2: In this part we will neglect the effects of the atmosphere. Using the given synthetic image of the Sun and calculating the PSF as we did in the hands-on, try to deconvolve the smeared image and obtain the original. You can do it in Fourier space, or solving a big linear system of equations (latter might prove too hard). Write down your observations and submit them with the results.

Notes: You do not have to submit the code, but it is certainly easier to grade if you submit it as a jupyter notebook or something similar.