

Weeks 13 and 14, with Connie Walker

Overview of: **Assignment 4 (due date: Tuesday, April 22)**
Assignment 5 (due date: Saturday, April 26)
Assignment 6 (due date: Tuesday, April 29)

Assignment 4, 5 and 6 – Estimating the Morphology and Magnetic Field Strength Of A Sunspot Region Over Time

- **Assignment 4a:** You will use archival data to study integrated intensity (LineI) data and magnetograms (Bgram data). The archival data consists of 12 sets of fits files from the NSO Near IR Array Camera used on the McMath-Pierce telescope during a 3-day run in December 2006. (Each set contains LineI, BGram, Dopplergram and StokesV images). The dataset was taken during solar flare eruptions and includes an X-class flare and a few M- and C- class flares. Examine the chart that correlates the flare events with observations.
- **Assignment 4b:** ImageJ will be used on the integrated intensity fits data to examine the differences in morphology as the sunspot region evolves. This is done by determining the area of the sunspot, the N-S (vertical) size of the sunspot and the intensity of the sunspot over the N-S (vertical) direction for the 12 LineI fits files. A small amount of spherical trigonometry will need to be included. The resulting quantities (area, size, intensity) will be plotted against time.
- **Assignment 5:** Image J will be used on the magnetogram data to examine the changes in magnetic field strength by plotting it in the N-S (vertical) and E-W (horizontal) directions. This will be done for the 12 Bgram fits files on the sunspot. A small amount of spherical trigonometry needs to be included (e.g., applying a multiplicative factor). The magnetic field strength can be plotted against time for any location long the sampled directions, but specifically for the maximum magnetic field strength.
- **Assignment 6a:** Graphical Analysis 3.1 will be used to determine the dispersion. The dispersion is determined through comparing specific lines in a spectrum at 1.565 μm from an NSO spectral atlas with the archival spectral data of the same lines. Dispersion corrections will be made to the archival spectral data (e.g., from a pixel to wavelength scale).
- **Assignment 6b:** Graphical Analysis 3.1 will be used to plot the spectra which show the maximum difference in wavelength of Zeeman-split IR Fe I lines for three of the 12 BGrams. (Each of you will take a different three.) Once you measure the difference in wavelength, you will solve the formula for magnetic field strength and, as a group, plot the result vs time. This is done as an exercise to understand how the magnetic field strength is determined and as a confirmation of the maximum field strength vs time plot determined from the magnetogram data.

At the end of the three weeks, we will put our results in the broader context of magnetic activities on and within the Sun.