RESEARCH LOG - WEEK 4

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1. Preparation for Loop Selection

This working week was shorter than usual thanks to the Independence Day celebrations. Monday and Tuesday were spent converting results from previous weeks into a suitable format for use in Professor Jiong's code. Furthermore, it was discovered that the 171Å map had not been generated correctly and so this was rectified. There were several bugs indentified in the code used and rectifying these issues proved to be rather time consuming. However, eventually both the results and code were ready for further analysis and so a loop selection meeting was arranged.

2. Loop Selection

Now began the demoralizing process of discarding the majority of the loops that had previously been traced. Professor Qiu had written a code that plotted the intensity of electromagnetic radiation detected at each wavelength as the flare developed. Below, Figure 1 displays the light curves associated with one particular loop.

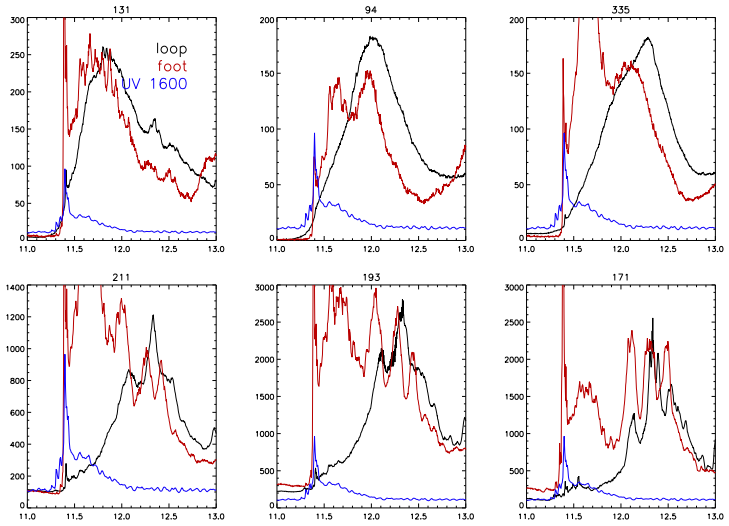

Figure 1. Light curves of one loop observed at different wavelengths

During the flaring process, energy is released in the corona and is transported to the much denser chromosphere below. The sharp peak seen at 1600Å and at the footpoints in all other wavelengths is representative of rapid chromospheric heating. Thermal energy is then transferred along the length of the loop through the process of evaporation. Following this transfer of energy, the loop begins to cool and as it falls to the characteristic temperature (see Week 3) for each wavelength, the intensity of that particular wavelength will peak. The delay between peak intensities for different wavelengths can then be used to infer the cooling rate. It was felt that this loop had been well identified as the light curves demonstrated clear heating and cooling phases. Consequently, this loop will be used for further analysis. The lightcurves associated with a discarded loop is shown in Figure 2.

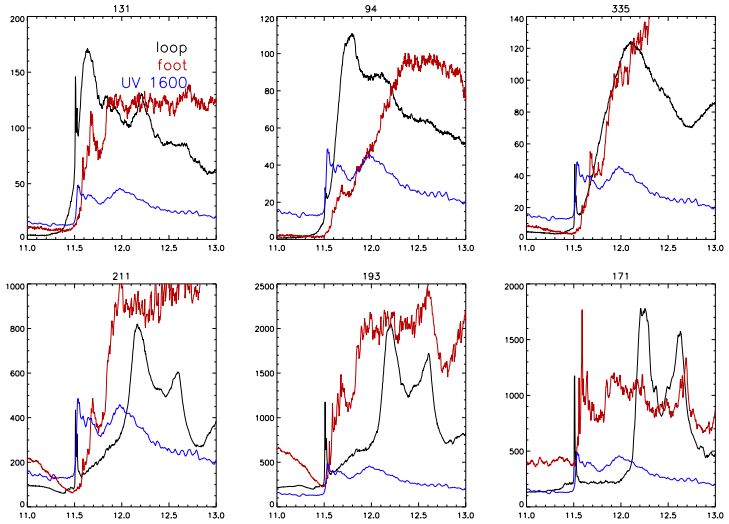

FIGURE 2. Light curves of a discarded loop

In this example, the initial rise in the 1600Å intensity is far less profound and radiation observed from the footpoints in other wavelengths behaves in a very different manner. There is no well defined peak in intensity of this radiation and whilst the intensity peaks for the rest of the loop are clear, for 171Å the peak occurs before the 1600Å peak. According to the solar community's understanding of solar flares, this should not occur and whilst there is a sense of only selecting loops that satisfy existing models, it is likely that radiation from neighbouring loops is being detected. This particular loop appeared during the late flare stage when the loop density is high. It is therefore likely that light from the surrounding loops is being detected.

3. Group Allocation

Once the desired loops had been selected, they were split into two major groups with a few other subgroups. The purpose of this exercise was to make subsequent loop modelling specific to similar loops. Group 1 loops were chosen to be those that developed in the South-West whilst Group 2 loops appeared in the North-East. Group 1 loops tended to brighten earlier in the flare event than their Group 2 counterparts, suggesting that the inital reconnection events occured in the South-West before spreading (in general, but not exclusively) North and East. Loops with perfect light curves were indexed with a star in order to determine which loops might be easily modelled whilst other very good loops were denoted as excellent. Furthermore, a set of loops with broad 1600Å peaks were identified as well as two loops that were exceptionally long and sheared between the two flare ribbons.

4. Lectures and Seminars

This week saw the return of a great deal of the solar department and consequently a seminar and two lectures were back on the timetable. Professor Qiu and Professor Longcope delivered lectures on solar eruptions and on the solar wind respectively. Professor Qiu's lecture provided a clear and concise summary of the solar phenomena being investigated by the REU students this summer. Professor Longcope, on the other hand, talked about the constant flow of solar plasma through coronol holes in the magnetic field. Dr Silvina Guidoni, a visiting postdoc from NASA and an alumni of MSU, delivered a talk on MHD simulations of solar flares. She spoke on the subject of magnetic island formation during reconnection events and how these provide a possible mechanism for accelerating ionized particles to energies required for the high-energy emission observed during solar flares.