Comparison Study of the Sun at Various Frequencies
Kayla Harward
Faculty Mentor: Dr. James E. Payne

Introduction
I spent six weeks during the summer of 2004 collecting solar data from various telescopes at various frequencies. I compared the data from the four radio telescopes and from the two x-ray telescopes and looked for correlations in the graphs. When I observed a correlation, I confirmed that it was caused by solar activity by viewing the optical pictures of the solar disk and by checking the solar activity levels on www.spaceweather.com.

I used the following telescopes to collect and analyze the data:

- The Small Radio Telescope (SRT) at SCSU. It is a dish telescope measuring 3 meters across. It operates at a wavelength of 21 cm or a frequency of 1.4 GHz.
- The Dual Antenna at SCSU operates at a wavelength of 2.08 m or a frequency of 144 MHz and at a wavelength of 14.3 m or a frequency of 21 MHz.
- “Smiley,” a dish telescope measuring 4.6 meters across located at the Pisgah Astronomical Research Institute (PARI) in Rosman, North Carolina. It operates at a wavelength of 21 cm or a frequency of 1.4 GHz and I used it primarily as a backup for the SRT.
- GOES-12, a National Oceanic and Atmospheric Administration (NOAA) satellite in orbit around the earth. It operates at wavelengths between 0.05 nm and 0.4 nm or frequencies between $6 \times 10^{18}$ Hz and $7.5 \times 10^{17}$ Hz. It also operates at wavelengths between 0.1 nm and 0.8 nm or frequencies between $3 \times 10^{18}$ Hz and $3.75 \times 10^{17}$ Hz.

Multiple telescopes are necessary at the same frequency to protect against equipment failure. Those of different frequencies are useful when observing the sun as different events are seen at different wavelengths – depending on their point of origin on the Sun. It is especially useful to compare radio or x-ray results with optical images in order to better understand what caused a spike in the data.

Objectives

- Verify pointing of the SRT at SCSU
- To observe the sun for approximately six weeks at the various frequencies
- To compare data from the various antennas
- To look for correlations between data from the antennas and the optical images

Results
Although I observed the sun during a period of relatively low activity, I did record several flares and coronal mass ejections (CMEs.) These bursts of activity are seen on the graphs as spikes. Many of the spikes were seen only on one telescope’s graph, but there were some that were observed on several instruments. I was able to confirm that the overlapping spikes did come from solar activity by viewing the optical images and by checking activity reports on www.spaceweather.com.

Acknowledgements:
This work was supported in part by funding provided to South Carolina State University by NASA OSS NNG04GD62G.