End-of-Semester Report
(Space Physics Group, Spring 2005)

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My work in the Space Physics Group this semester, under the mentorship of Dr. Desai, consisted of three projects. The first was to write a procedure in IDL to identify upstream events from WIND data and to produce an expose file so that the composition of those events could be determined. The second was to pick out, by hand, the start and stop times for shock events in ACE and WIND data. Finally, I was to write a Java program that would gather data from MIT's shock analysis website and store that data in a spreadsheet for use by Dr. George Ho at the Johns Hopkins University Applied Physics Lab. I was able to complete all of these projects before the end of the semester while learning some of the basic physics involved as well as some of the techniques used by space physicists in their research.

I. UPSTREAM EVENTS

The vast majority of my work involved designing and implementing an algorithm to identify upstream events in WIND data and report the times of these events. These time intervals could be plotted and refined by hand and then merged with the intervals identified in Dr. Desai's previous work. The relative abundances of elements during these events could then computed and used to determine the source of these events.

The algorithm operated by interpolating the data, averaged over short time intervals, in order to form a base curve. The procedure then looked for consecutive data points lying significantly above the base curve. If the duration of these sequences of points were too long, they were considered to be of a different class of events and thus dropped. Once the potential intervals of interest were identified, they were plotted on top of the original data and checked manually. False positives were then removed from the output, and significant missed events were added. The final set of intervals was then replotted to serve as a visual record of which events were chosen for analysis.

As a check, the results of my procedure were also compared with Dr. Desai's previous results for the years between 1994 and 1998, and the two were found to be consistent with one another. The final expose file contained Dr. Desai's set of intervals for 1994-1998 augmented by my new set of intervals for 1998-2005.

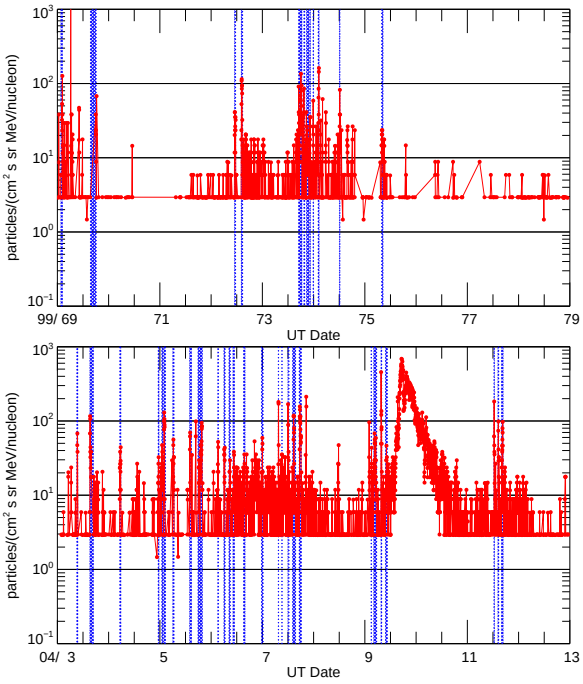

FIG. 1: Example 10-day plots highlighting upstream events identified by the program.

II. SHOCK TIMES

In addition to writing my IDL procedure to automatically extract start and stop times for upstream events, I also picked out start and stop times by hand for 224 shocks observed by both ACE and WIND. The product of this work was a spreadsheet containing the reported time for the shock, the start and stop times if a shock was visible in the data, and a quality value indicating my confidence in picking out the shock. The start and stop times for the shocks with good quality values were then put into an expose file for later analysis.

III. SHOCK ANALYSIS EXTRACTOR

My final project for the semester was to write a program that would parse web pages on MIT's shock analysis website and save the parameters of interest to a local spreadsheet. The program was to be used by Dr. George Ho at JHU APL, who provided me with an initial list of the parameters he wanted to be extracted.

I chose to write this program in Java, as it is the language I am most familiar with and features existing libraries for parsing HTML documents. Furthermore, it is

a cross-platform language, so my program would run regardless of the operating system used on the computers at JHU. I designed the program so that additional parameters could be specified by the user for extraction in a configuration file separate from the source code. This made it trivial to add new parameters to the output when Dr. Ho requested them. The user can also specify an alternate URL from which to extract the data, and a Goddard mirror of the shock analysis site was included as an example. I also delivered the resulting spreadsheet containing data on all of the events through Spring 2005.

IV. CONCLUSION

While working in the Space Physics Group over the Spring of 2005, I learned a lot about what kinds of questions are asked in space physics and how those questions are answered. I also became acquainted with some of the tools used by scientists studying space physics, especially IDL. I am glad that I was able to use my previous programming experience to develop two useful applications over the course of the semester. On the whole, working in the Space Physics Group was a positive experience for me, and I hope that I was able to help out the group in some small way while I was there.