LETTER TO THE EDITOR

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"Solar Maximum Mission and Simultaneous Visual Observing"

This letter is an appeal for amateur astronomers with interests in solar observing to make a most significant contribution to the field of solar flares in a simultaneous observing program with NASA's repaired solar satellite: "Solar Max." It is expected that the satellite will continue operations well into the rise of activity of the next solar cycle, which has indications of being a particularly active one. The purpose of this letter is to describe an important new observing program for those amateurs who possess the proper equipment.

Thanks to the effort of the crew of the space shuttle Challenger, the Solar Maximum Mission (SMM) satellite received a second chance to study the sun in April of 1984. Since its repair, most of its instruments have continued to function well, with a significant fraction of the science efforts devoted to high time resolution observations. One of the discoveries of SMM is that solar flares occasionally undergo rapid changes in hard x-rays and at ultra-violet wavelengths. An example of these rapid fluctuations is shown in Figure 1. In the upper frame I show a hard x-ray time profile of approximately 47 seconds of a solar flare which occurred on May 10, 1980. Five seconds of that figure is expanded in the lower frame, which shows several "spikes" with durations of less than one second. It is believed that these spikes are caused by bursts of high-energy electrons (caused by some unknown acceleration process) racing down a magnetic flux tube and crashing in to the sun's chromosphere, producing x-rays. There are theoretical predictions that these x-ray bursts should be simultaneous with bright flashes of light in the hydrogen emission lines and in particular the line known as H-alpha. Although there is some weak evidence which suggests that H-alpha does vary on extremely short timescales, new observations are desperately needed to test theories.

The instruments on the SMM satellite cannot simultaneously observe with high time resolution and with high spatial resolution. Furthermore, the satellite cannot observe at optical wavelengths. Although both the Big Bear and the Sacramento Peak solar observatories occasionally can observe with SMM at high time resolution, observing time cannot always be allocated on the spur of the moment and the best flares with rapid changes have had the habit of occurring at night or behind clouds. However, as many professional astronomers know, it is hard to cloud out the AAVSO!

Details of the observing program are as follows: to observe an active region in the light of H-alpha with a video camera and to record the images on a standard video recorder. It would seem that even a 4-inch aperture could provide resolutions of 2-4 arc seconds which would be sufficient. Absolute timing is essential and could be provided by simply recording WWV on the audio channel. For useful video images, the telescope must also track well at the solar rate. Observations would need to be obtained only during alert periods, typically lasting four or five days, as determined by the detection of rapid activity by SMM. On a daily basis, an AAVSO coordinator, or perhaps the observers directly, would be informed by SMM scientists of which periods of time contained interesting events. In this way the amateur would not need to spend time reviewing the tapes and they could be reused as soon as it were known that no events could have been recorded. Also, the observations would not need to be continuous since SMM is in sunlight only 60 minutes of each 93-minute orbit. It might therefore be possible for the recorder to be preprogrammed,

allowing for unattended observations. Analyses of tapes with flares would be performed at NASA's Goddard Space Flight Center in collaboration with the contributing observers. Interested observers should write to Janet A. Mattei at the AAVSO. Please include information about your available equipment and telephone number(s) where you may be reached.

In conclusion, it appears that advanced amateur astronomers could make a very significant contribution by identifying bright patches of light in solar flares. The time variations of these points, which may represent the footpoints of flaring loops, may be compared with precisely-timed x-ray and UV satellite observations, allowing many critical tests of theories of solar flares.

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