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OBSERVED AND THEORETICAL SPECTRA IN THE 10-100Å INTERVAL

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Résumé --- Les spectres en rayons x mous (de 10 à 95 Å) obtenus par de deux vols de fusées sondes (1982 et 1985) sont comparés avec les spectres prédits. Nous montrons le tracé densitométrique des spectres de la nouvelle expérience de 1985. Cette note comparé les intensités des raies avec les prédictions.

Abstract --- The soft x-ray spectra recorded in two sounding rocket flights in 1982 and 1985 are compared with with predicted spectra. The poster presents the processed densitometer trace of the full spectrum together with the new spectrum from the 1985 experiment. This note compares the intensities of the lines with predictions.

We compare the x-ray spectra from the XSST, a 5m grazing incidence spectrograph behind a paraboloidal collecting telescope with predicted line intensities. The observations were made in July 1982 and October 1985. Data observed in the 1982 sounding rocket flight was published in Ap. J. [1]. The poster presents the densitometer trace of the full spectrum together with the new spectrum from the 1985 experiment. This contained some 50 lines from an active region where a flare had occurred about 1 hour previously. While the latter data set is less extensive, many of the same lines are observed. On the same charts, a simulated spectrum based on an emission measure model folded through tables of line intensities is shown. The model includes atomic physics and ionization balance results of Mewe[3].

The spectrum studied here covered the 10 to 95Å region and was obtained with a grazing incidence x-ray spectrograph aboard a sounding rocket. The flare of 1982 July 13 16:27UT was observed. This was judged as class C9.1 (almost class M1) by NOAA. Our data was taken 2 minutes after the soft X-ray maximum, and the field of view includes emission from loop tops, though we cannot rule out the inclusion of radiation from footpoints.

The 35mm Kodak 101-07 film was traced in a recording microdensitometer in 77 traces, creating a magnetic tape containing the position and density information. This was then processed to numerically superimpose the traces, correcting for the curvature and tilt of the lines. A set of summed densitometer traces, together with the photographic enlargement of the spectrogram, formed the raw data set for the spectral identification and intensity analysis reported in Acton et.al. [1]. Some 400 lines were tabulated and all but four strong lines identified. In the 1985 data set, the lines were considerably weaker and film noise is more visible.

Figure 1 is an illustration of one of the pages presented in the poster. The tracing of the 1982 data show the two exposures, the first of 54 s and the second of 145 s which appear on the same segment of film displaced by about 0.5 mm on the original film. The second, or more intense, spectrum has been used in the work described in this paper. (This data set was used to determine electron density to be $3 \times 10^{10} \text{ cm}^{-3}$ over the temperature regime covered.[2]) The 1985 data, plotted as the lower trace, is from a 3 min. exposure.

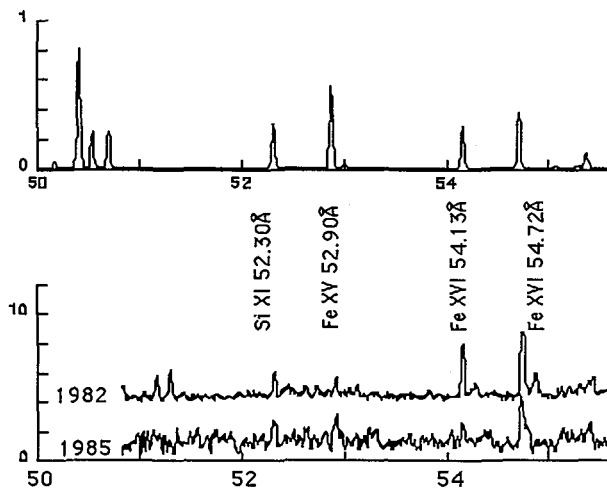


Fig. 1 --- Theoretical Spectrum Above--Exp. below

Several attempts have been made to fit a uniform emission measure curve to a subset of the lines in the 1982 data set. A forthcoming paper by McWhirter, Lemen *et.al.* will discuss the results of these calculations. A less sophisticated estimate may be obtained by assuming each line to radiate at the temperature of peak emission. To investigate this, a set of 156 lines was selected from the XSST data. For each of these lines the wavelength and identification agree with that given in the Mewe tables. Using a Pottasch type [4] temperature analysis, where individual spectral lines are assumed to be formed in a temperature interval in which the emission function is greater than 0.33 of the value at the maximum, the ratio of the observed line intensity with the predicted intensity is given in units of $\text{cm}^{-3} \text{ arcsec}^{-2} \text{ } ^\circ\text{K}^{-1}$ in Figure 2. This plot separates the lines by atomic species, as indicated by the symbols in the right margin. The vertical scatter in the points plotted here is only partly accountable by observational error. We estimate 20% relative error [1].

There are 66 points for iron ions and the small dot symbol was used for clarity. A separate plot, Figure 3, analyzes just the Iron ions.

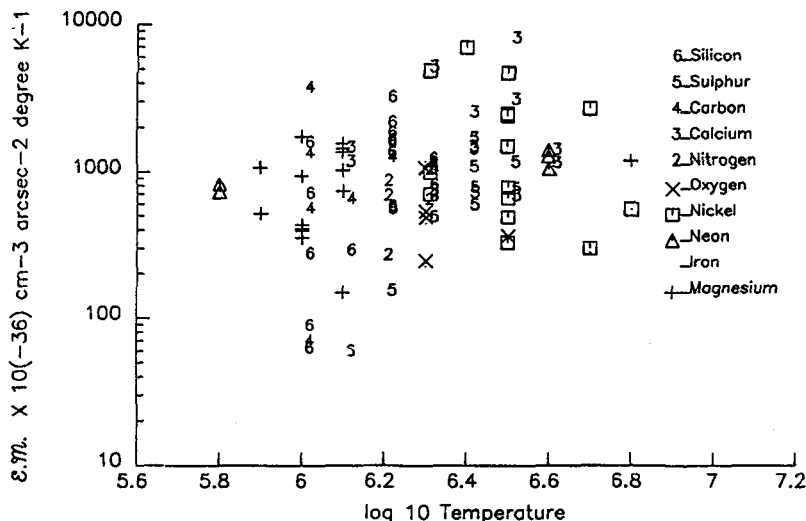


Fig. 2 --1982 XSST Data. Observed intensities of 156 lines relative

The point labeled with the arrow in Fig. 3 is due to the 69.65Å line, which is here compared with the possible prediction for the Fe XIV line at this wavelength. We rejected this identification in [1] because the observed intensity was too great. In the 1985 data set, shown in Fig. 4, the same line appears as the highest point on the plot when we again associate it with Fe XIV.

In Figure 4, the data obtained in the 1985 sounding rocket experiment is plotted. Only 33 lines were available for this analysis, and not every atomic species is represented.

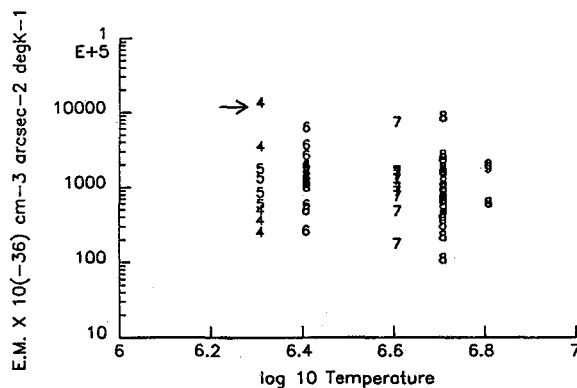
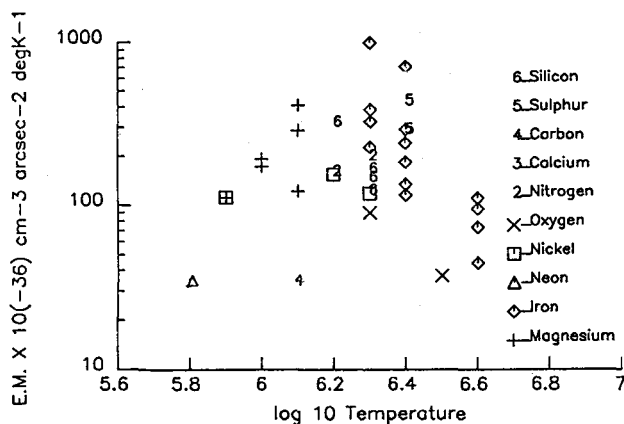


Fig. 3. 1982 XSST Data Fe Ions only. The number plotted indicates the ionization stage.

“The spectrograph sampled x-rays from a 22×28 arcsec field of view in 1982, as explained in Ref. [1]. The flaring region was estimated to be 7 arcsec in width from data taken with co-aligned broadband x-ray detector. The 1985 data, (figure 4) although obtained by the same instrument, came from a 2×28 arcsec field of view since we detected no pointing drift during the exposure. From the 1982 data we determined the electron density to be $3 \times 10^{10} \text{cm}^{-3}$ [2]. At the peak of the emission measure plot in Figure 2, where $\text{Log}T = 6.4$, we find $EM \approx 2 \times 10^{39} \text{cm}^{-3} \text{arcsec}^{-2} \text{deg}^{-1}$. Using the unsmeared 2×28 field of view, and assuming a peaked temperature emission function for each line of width $0.2 \times 10^6 \text{deg}$, we find the total emission measure, $n_e^2 dV$ to be $2.2 \times 10^{46} \text{cm}^{-3}$. Dividing by the known square of the electron density we find the volume to be 8 cubic arcsec for plasma in this temperature interval.”



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