A HIGH-RESOLUTION SOLAR SPECTRUM 2000 Å–2200 Å

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A high-resolution solar spectrum in the range 2000–2200 Å was obtained in a recent flight of a sunpointing Skylark rocket. This was launched at 04.21 hr UT on April 22, 1969 from Woomera and reached an apogee of 178 km. An optical alignment system operating on the main vehicle pointing system gave a net stabilisation of ± 3 arc sec in the position of the solar image relative to the spectrograph slit. The slit, of length 1.0 mm, was set in the north-east quadrant parallel to and 5 arc min from the north/south axis, its lower edge being 1 arc min from the equator. The roll control of $\pm 2.5°$ was provided entirely by the standard Elliott Bros. type of vehicle stabilisation.

The spectrograph is an all-reflecting echelle system incorporating (in order of the light progression) a 1-m concave collimator, a plain echelle of 73.25 groove mm^{-1} and a 1-m concave grating acting as a camera mirror and cross-disperser. The system corresponds to an Ebert configuration in the direction of the echelle dispersion, and to a Wadsworth configuration in the direction of the grating dispersion. The two-dimensional spectral format is recorded on Kodak 101-01 photographic emulsion. The collector mirror and collimator are both coated with Ge + ZnS multiple coatings to give a high discrimination against longer wavelengths and thereby solve the scattered light problem. The echelle and concave grating were both coated with $Al + MgF_2$. The linear dispersion is about 1 Å mm^{-1} and the spectral resolution (pre-flight) of the instrument was measured as 0.02 Å in the laboratory for the operating slit width of 0.018 mm.

During the flight, four exposures of 10, 25, 100 and 50 sec were obtained in that order from 130 km through apogee to 140 km. Solar spectra were recorded over the range 2000–2200 Å and the background fog density was 0.1 on the longest exposure.

The spectrum obtained from the 50-sec exposure is reproduced in Figure 1. An examination of the detail indicates a flight resolution of 0.03 Å, and extends the high resolution solar spectrum to wavelengths below that obtained by Purcell *et al.* (1963). The solar spectrum is still particularly rich in this region and contains nearly 500 detectable absorption lines. Identification of the lines has just started and many are due to Fe I and Fe II. An interesting feature is a broad (~ 1.5 Å) shallow absorption line which can be seen crossed by a number of sharp lines in the fifth echelle cycle near 2124 Å. The possible source of this feature has not been identified at the present time.

The echellogram embraces the absorption edge present in the solar spectrum near

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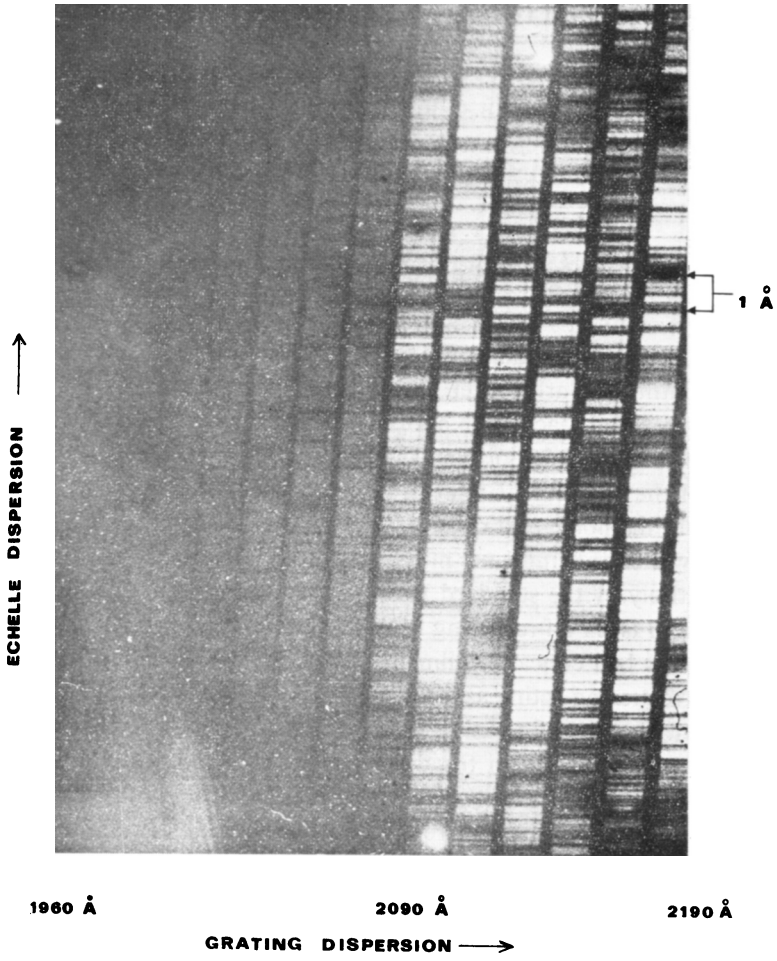

Fig. 1. High-resolution solar spectrum.

2090 Å, suspected to be due to AlI (Tousey, 1963; Bonnet *et al.*, 1967). In Figure 1 this is more apparent in the frame of the grating dispersion and appears as a sudden drop in the intensity of the eighth visible echelle cycle. The photometric reduction of the echellogram, which will take out the echelle 'ripples' by reference to a laboratory continuum source, should reveal an accurate location of the edge and the high resolution will enable checks to be made on the element responsible by a search for the lead-in members of the series.

References

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Discussion

Underhill: Could the broad shallow line be an auto-ionization line?

Wilson: That is one possibility, but we have not been able to find such a line at that wavelength in the published data on autoionization spectra.

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