LETTERS TO THE EDITOR

PHYSICAL SCIENCES

Prediction of the Coronal Structure for the Solar Eclipse of March 7, 1970

On March 3, I made a prediction of the coronal structure of the March 7, 1970, eclipse of the Sun. The model employed is similar to that used for the prediction of the coronal structure at the eclipse of September 22, 1968, and details of the method are described in ref. 1. Observations of this eclipse seem to support[2] the model: "there is a general similarity between the two drawings" (prediction and observation)[3], and a sketch of the observations "agrees well with the prediction; had Schatten drawn his streamers more nearly radial, the agreement would have been almost perfect"[4].

A "source surface" at one solar radius above the photosphere was used in the present prediction, rather than one at 0·6 solar radii as used in the earlier work, to allow for the more active Sun. Comparisons of calculations obtained with this newer value at the end of 1968 agree more closely with observations of Faraday rotation from Pioneer 6 that provided a measurement of the coronal magnetic field (unpublished work of Stelzried *et al.*). Altschuler and Newkirk[5] use a zero-potential surface at 1·5 solar radii above the photosphere for comparisons with the solar eclipse of November 1966. I agree that the method of Altschuler and Newkirk for calculating coronal fields is superior, in principle. I have not had time to incorporate the improvements suggested by these authors into the present work. In practice, however, it is my opinion that uncertainties in the measured photospheric vector magnetic field and in accounting properly for the effects of the coronal plasma outweigh the differences in the two computational techniques. The effects of sunspot magnetic fields, as well as the photospheric magnetic field, were included in this analysis in accordance with Altschuler and Newkirk's work.

Fig. 1 is a prediction made on March 3 of the structure of the March 7, 1970, eclipse of the Sun (total over Mexico, the United States of America and Canada). Solar magnetic observations for this eclipse prediction were terminated on February 26, 1970, due to poor weather conditions in Pasadena, California. A list of the predicted coronal features within 60° of latitude from the solar equator is as follows. They are listed with their position angles (counter-clockwise from the north pole) in approximate order of decreasing brightness and certainty: bright features (condensations) at 288° and 95°; streamers from 100° to 120° overlying coronal arches located at 100° and 110°; helmet streamers from 30° to 70° centred on 50° and from 285° to 310° centred on 302°; coronal arches located at 75°, 292° and 278°; broad streamers without arches from 235° to 270° and from 120° to 150°; narrow streamers possibly with greater radial polarization at 235° and at 145°.

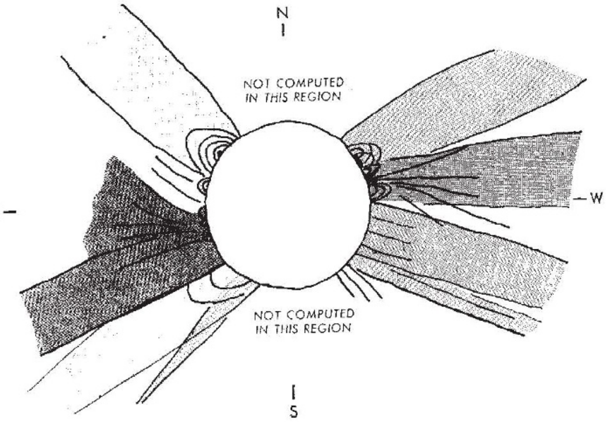

Fig. 1. Eclipse prediction drawn March 3, 1970.

The March 7, 1970, solar eclipse will probably be somewhat brighter and more elliptical in appearance than the September 22, 1968, eclipse (total over Siberia). This results from a greater number of regions of solar activity appearing in the lower latitudes following sunspot maximum.

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Indigenous Lunar Methane and Ethane

RECENT analyses[1,2] of Apollo 11 lunar samples have shown that CH_4 (up to 6 $\mu g\ g^{-1}$) and other gaseous hydrocarbons, ranging from C_2 to C_4, are released on treatment of the fines with aqueous HCl, H_3PO_4 or HF. It was uncertain whether these hydrocarbons were formed by acid hydrolysis or were present as such. We have now shown that methane and ethane arise from both sources.

Samples of Apollo 11 lunar fines (sample 10086·19 bulk fines D) have been examined in two ways; first, by crushing the sample *in vacuo* and examining by mass spectrometry the gases released and, second, by treating the sample with DCl and analysing the isotopic compositions of the methane and ethane. The analytical procedures have been described in detail elsewhere[2,3].

An aliquot of the sample was pulverized by shaking for 16 h in an all-glass ball mill after a vacuum degassing procedure (150° C, 10^{-6} torr, 30 min) to remove adsorbed terrestrial gases. The gases released by crushing included the rare gases (He, Ne and Ar), with Ne and Ar in the lunar isotopic abundances previously measured at the Lunar Receiving Laboratory[4]; CH_4 (1 $\mu g\ g^{-1}$) and C_2H_6 (0·1 $\mu g\ g^{-1}$) were also released (Table 1). A blank experiment conducted with the mill alone revealed only trace quantities of atmospheric gases. In a second experiment, D_2O (99·8 per cent, *c.* 1 ml.) was added to an aliquot of the sample in the ball mill and evaporated under vacuum (150° C, 10^{-6} torr). This procedure was repeated four times in order to exchange, as far as possible, all protonated species (particularly H_2O) with deuterated analogues.