

Lawrence Berkeley National Laboratory

Recent Work

Title

AIRBORNE SPECTROGRAPHIC OBSERVATIONS OP THE SOLAR ECLIPSE OF NOVEMBER 12, 1966

Permalink

<https://escholarship.org/uc/item/4q74n5j8>

Authors

Conway, John G.
Morris, William F.
Andrews, C. Frederick.

Publication Date

1967-04-01

University of California

Ernest O. Lawrence Radiation Laboratory

AIRBORNE SPECTROGRAPHIC OBSERVATIONS OF THE
SOLAR ECLIPSE OF NOVEMBER 12, 1966

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545*

Berkeley, California

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

Submitted to the Astrophysical Journal

UCRL-17506
Preprint

UNIVERSITY OF CALIFORNIA

Lawrence Radiation Laboratory
Berkeley, California

AEC Contract No. W-7405-eng-48

AIRBORNE SPECTROGRAPHIC OBSERVATIONS OF THE
SOLAR ECLIPSE OF NOVEMBER 12, 1966

John G. Conway, William F. Morris and C. Frederick Andrews

April 1967

AIRBORNE SPECTROGRAPHIC OBSERVATIONS OF THE SOLAR ECLIPSE OF NOVEMBER 12, 1966*

John G. Conway
Lawrence Radiation Laboratory, University of California
Berkeley, California

William F. Morris and C. Frederick Andrews
Lawrence Radiation Laboratory, University of California
Livermore, California

On November 12, 1966, a total eclipse of the sun was observed from a C135 "flying laboratory" instrumented by the Lawrence Radiation Laboratory. Mid-totality occurred at 14 hrs. 18 min. UT off the coast of Rio Grande, Brazil at $35^{\circ} 35'$ south and $49^{\circ} 40'$ west. The aircraft flying at an altitude of 33,000 feet and at a ground speed of 550 knots remained in the eclipse shadow for 3 minutes and 22 seconds.

During totality, the spectrum of the solar corona was photographed over a wavelength region extending from 3000\AA to 6750\AA . Two spectrographs were employed in the airborne experiment. The primary spectrograph, a Czerney-Turner F/6.3 was shock mounted in the aircraft and illuminated with the coronal image by means of an automatic tracker. The instrument, equipped with a 1200 g/mm grating blazed at 5000\AA gave a linear dispersion of $9 \text{\AA}/\text{mm}$. Two settings of the grating were required to cover the spectrum wavelength range of 3800\AA - 6750\AA which was photographed on Kodak type 103aF plates.

The second instrument, a Hilger F/4 prism spectrograph was mounted in a special carriage which allowed manual alignment of the instrument with the sun. During totality six exposures were taken in the wavelength

This work was performed under the auspices of the U. S. Atomic Energy Commission.

region 3000\AA - 5400\AA . The spectra were photographed on Kodak 103a0 plates.

The Czerney-Turner spectrograph received a radial image of the corona which was focused on the 13 mm high slit of the spectrograph. The edge of the moon appeared on the lower 3 mm of the slit and the corona, extending out 3.5 solar radii, filled the remaining height of the slit. This afforded a means of observing the intensity profiles of the coronal lines from the limb of the sun to the outer corona. Approaching second contact the bright crescent of the sun fell directly below the slit and after third contact the crescent appeared on the slit. Four exposures were taken on the Czerney-Turner spectrograph. These included two exposures at each of two wavelength settings as follows: a 15 sec. exposure immediately after second contact followed by a 60 second exposure, then another 60 second exposure at the new wavelength setting followed by another 15 second exposure before third contact.

In general, the objectives of the spectrographic observations were realized. It should be noted, however, that the intensity of the coronal light incident on the Czerney-Turner spectrograph was weaker than anticipated due, in part, to optical losses. Also there were solar prominences in the region observed. As a result, only two coronal lines 5303\AA and 6374\AA were recorded in the high resolution spectrum along with prominence emission lines due to H, He and CaII. The widths of the two coronal lines were measured to yield the calculated coronal temperatures listed in Table I. Limb to corona intensity profiles of the observed lines have been recorded. These are shown in Figure I. The unusual spatial profile of the CaII lines in which CaII reappears at a point one solar radius above the limb is not

explained. The presence of CaII in the middle corona is not consistent with the temperature prevalent in that region.

Of the six spectra photographed on the Hilger F/4 spectrograph, five spectra show coronal lines superimposed on chromospheric and prominence lines due to TiII, CrII, CaII, He and H. One spectrum displays predominantly coronal lines with the exception of CaII and HeI lines. Table II lists the coronal lines observed. All of the lines with the exception of 3073\AA and 3021\AA have been observed by other investigators. The two additions in our listing have been attributed to coronal emission after eliminating the possibility of their being chromospheric or prominence lines. The wavelength 3073\AA could be presumed to be TiII. However the stronger lines of TiII, e.g., 3075\AA , 3078.6\AA , and 3088\AA are not present in the one predominant coronal spectrum. These strong TiII lines are present in the superimposed coronal-chromospheric spectra. The 3021\AA line may correspond to a previously observed coronal line at 3010\AA listed by Billings.⁽¹⁾

Table I
Coronal Temperature Calculated From
Coronal Line Widths

<u>Line Wavelength</u>	<u>Identification</u>	<u>Half Width</u>	<u>Temperature</u>
5303 \AA	Fe XIV	0.80 ± 0.08	$2.5 \times 10^6 \text{ }^\circ\text{K}$
6374 \AA	Fe X	0.81 ± 0.08	$1.8 \times 10^6 \text{ }^\circ\text{K}$

Table II

Coronal Lines Observed with Hilger F/4 Spectrograph

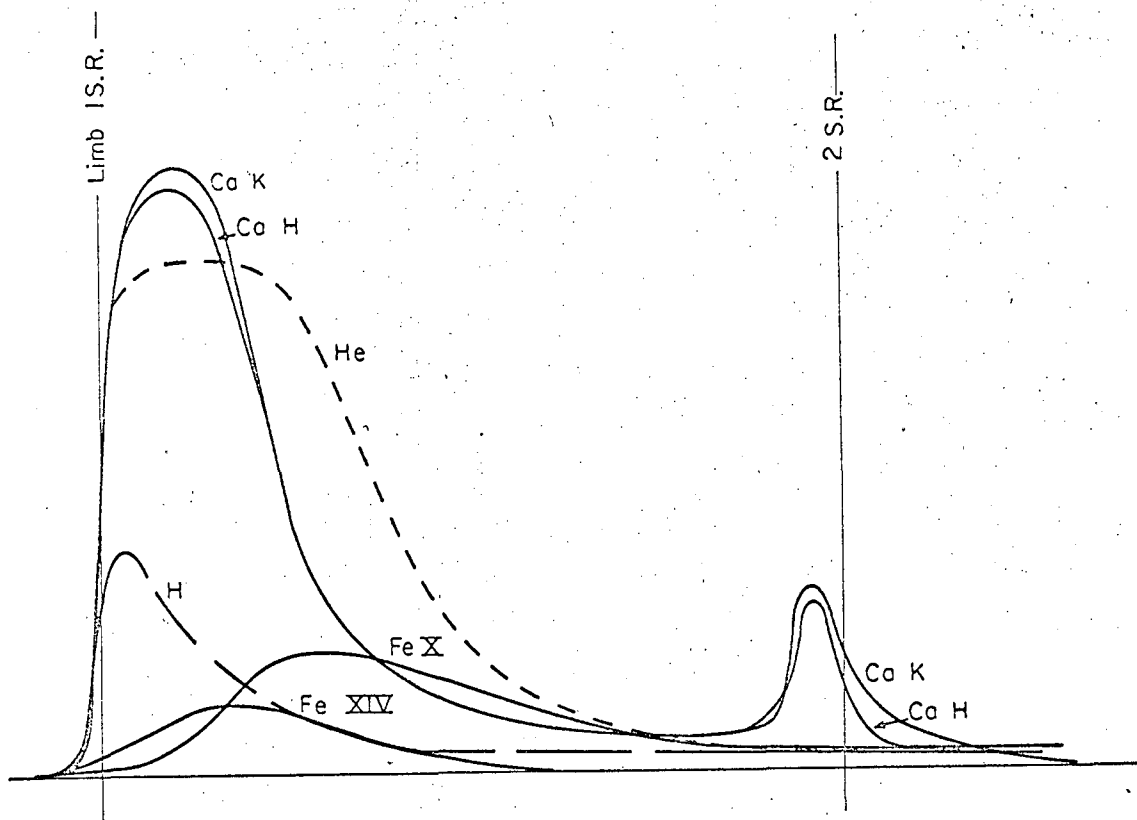
5303Å	3454Å
4231Å	3388Å
3987Å	3327Å
3801Å	3170Å
3643Å	3073Å
3601Å	3021Å

- (1) Billings, D.E. 1963, The Solar Corona, ed. J. W. Evans, (New York, Academic Press), p. 286.

Figure Caption

Fig. 1. Limb to Corona intensity profiles for H at 4340 \AA , Fe XIV at 5303 \AA , He I at 5825 \AA , Fe X at 6324 \AA , Ca H at 3968 \AA and Ca K at 3933 \AA .

BBN



xBL673-2367

Fig. 1

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

