An Emission Line in the Solar Spectrum near K.

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Photographs of the spectrum of the limb of the sun obtained recently reveal the presence near K of a rather faint narrow emission line, which does not appear to have been described previously. Unlike the emission lines of calcium, H_2 and K_2, this radiation appears to be uniformly distributed, and I believe is always present. It is, in fact, the only emission line in the visible region of the spectrum which has this character. It varies in apparent intensity, being clearly seen only in photographs obtained in a non-diffusive sky.

In spectra obtained with the slit radial to the limb, the line can be traced inwards over the disc for about a minute of arc, but it seems to be entirely absent in the central parts of the disc and in spot regions except when these are close to the limb.

The approximate position of the line is 3934·80 I.U., or in Rowland's system of solar wave-lengths 3934·94. In Rowland's Preliminary Table seven absorption lines are given between the line 3932·785 and the line 3935·463; that is to say, superposed upon the broad absorption bands of the K line, and one of these, 3934·818, of intensity 0, is near to the new line. I have studied a great number of high-dispersion

plates of this region, representing the centre of the disc and the limb, but have failed to detect this absorption line, or any of the others, although two of them are entered in the table as of intensity 8. There are similar discrepancies in the neighbourhood of H, where Rowland gives two lines of intensity 6, of which no trace can be seen on any of my plates, whether grating or prism spectra.

The plates which show the emission line most clearly form part of a series I am photographing at Ewhurst for the purpose of measuring the rotation speed of the prominences at a considerable height above the chromosphere. The spectra represent sections of prominences appearing on the eastern or western limbs, and the slit, which is tangent to the limb, in some cases intersects a small part of the disc. Such spectra usually show the emission line superposed on the shading of K. It is also seen in some spectra taken with the slit radial to the sun and intersecting the limb in a higher latitude than is represented by the prominence spectra.

As to the origin of the line, it might be suggested that it was the K line of calcium much displaced by motion, and having some analogy with the "stationary" calcium lines in early-type stars. In this case a similar line would appear on the red side of H, but it does not appear to be present. The displacement with regard to the normal solar position of K would imply a recession of 85 km./sec., so that if it were the K line, due to external very tenuous calcium, it would be necessary to suppose that the solar system was moving through the calcium cloud with a velocity at least as great as this. The suggestion is, however, negatived by the fact that my measures clearly show that the line is displaced normally to red and to violet on the west and east limbs by reason of the solar rotation.

I give below the values obtained from six plates, which are the only ones I have obtained that give measurable images of the line.

Date.	Latitude East.	λ I.U.	Date.	Latitude West.	λ I.U.
1926 Aug. 1	+14°	3934·783	1926 Aug. 7	−13°	3934·822
1926 Aug. 14	+15°	3934·797	1926 Aug. 11	−14°	3934·824
1927 Jan. 23	− 8°	3934·773	1927 Jan. 23	+ 8°	3934·835
Means East	12°	3934·784	Means West	12°	3934·827

Mean of East and West 3934·806 ± ·002.
Observed Rotation Shift 0·022 A.

Applying the usual corrections to the observed shift, the equivalent value of the sidereal rotation is 1·86 km./sec., which agrees almost exactly with the normal value of the reversing layer in latitude 12°.

It is to be noted that the measures have been referred to the comparison spectrum, impressed on all the plates, of the iron arc, and not to the solar absorption lines, for the reason that recent measures of the wave-lengths of the iron lines by St. John and others (*Transactions of the International Astronomical Union*, **1**, 41) are far more reliable than Rowland's values of the solar lines. But in comparing a terrestrial

source with the sun, we have to reckon with Einstein's predicted shift towards red in the sun. The mean value of the wave-length obtained above is therefore subject to a correction of − 0·008 A to reduce it to the terrestrial equivalent. If the origin of this emission line should be found on earth, it would therefore have the value 3934·798 I.U.

It is of interest in this connection to mention that in carrying out the original intention of measuring the rotation velocities of the prominences I have found that the H and K lines at a height of between 10″ and 30″ above the chromosphere are each of them displaced towards red, when referred to the terrestrial iron lines. The mean displacement derived from twenty-nine prominences is the same for H and K, and amounts to + 0·009A, the predicted value being + 0·008A.

The results of the prominence measures will be the subject of a separate communication, when a sufficient number of plates has been studied.

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