The Mount Wilson Photographic Map of the Sun-Spot Spectrum

Some years ago the Mount Wilson Observatory issued a photographic map of the sun-spot spectrum, but the scale was small and the mode of preparation otherwise unsuitable for exhibiting the interesting phenomena caused by the magnetic field present in every spot. In order to show these phenomena as well as possible, a new map, covering the region $\lambda$ 3900-$\lambda$ 6600, has just been completed, and will be placed on sale at cost.

The negatives from which the map was made were taken in the second order of the 75-foot spectrograph used with the 150-foot tower telescope. They were afterwards enlarged to a scale of one centimeter to the angstrom, in order to show the separation of the lines caused by the magnetic field. The polarization phenomena characteristic of the Zeeman effect are rendered visible by the aid of a Nicol prism and compound quarter-wave plate mounted above the slit of the spectrograph. Thus in a normal triplet, such as $\lambda$ 6173 or $\lambda$ 6303, the red and violet $n$-components, which are elliptically polarized in opposite senses, are reflectively transmitted to successive strips of the quarter-wave plate.

Only a few of the numerous and complex phenomena shown on the map can be mentioned here:

1. It will be observed that the separation of the components of lines affected by the field becomes gradually smaller, on the average, in passing from the red toward the violet end of the spectrum. This is due to the fact that, in harmony with Preston’s law, the mean magnetic separation is proportional to the square of the wavelength.

2. The telluric lines naturally show no magnetic effect, and the same is true of the great majority of the band lines, which represent compounds (including magnesium hydride, titanium oxide, and calcium hydride) rendered conspicuous in the spot by the reduced temperature.

3. All types of magnetic separation found in the laboratory are undoubtedly present, but the intensity of the magnetic field, which does not often exceed 3500 gausses (for $\lambda$ 6173), is usually insufficient to resolve lines having more than three or four components.
(4) The magnitude of the separation is not dependent solely upon the separation observed in the laboratory at unit field-strength, but also varies with the size of the spot and the level in the spot represented by the line in question. Thus high level lines, like H₂ and K₂, show very small displacements, while many lines corresponding to low levels, where the field-strength is much more intense, are widely separated.

(5) The polarization phenomena agree in general with those observed in the laboratory at similar angles with the lines of force, but there are certain notable exceptions that deserve careful study. One of these is illustrated by the behavior of the $p$ (central) component of triplets like $\lambda\ 6173$, which may be seen on the map to show small displacements. These would seem to indicate that this line, instead of being single and plane polarized, as observed in the laboratory, consists in the spot of two components, each elliptically polarized in the sense opposite to that of the corresponding $n$-component.

(6) The intensities of the spot lines, which in many cases differ widely from their intensities in the solar spectrum, can be largely accounted for by the combined effects of level, magnetic field, and reduced temperature.

The interpretation of the spot spectrum is being worked out with the aid of laboratory experiments, and special provision has been made for the investigation of lines showing exceptional polarization phenomena.

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The Spectrum of Nova Cygni No. 3

The announcement of the discovery of *Nova Cygni No. 3* reached the Lick Observatory on August 23rd. Observations of its spectrum were made on that night and have been continued at intervals of a few days to the present time.

The star was at its brightest on the evenings of the 23rd and 24th, when its magnitude was estimated at $2\frac{3}{4}$. The observers of Harvard College Observatory place the time of maximum more precisely on August 23rd, and its brightness as 1.9. After August 24th it fell away rapidly in intensity and is now of about the 6th magnitude and accordingly shines with but one-fortieth of its former brilliancy. The first spectroscopic observations were therefore made at about the epoch of maximum and have covered the first part of the waning of the star's light.