cm^3 in the fainter, more extended nebulosities and of the order of 10–30 electrons/ cm^3 in the moderately bright knots and condensations. These densities are similar to those found in the interstellar medium and diffuse nebulae in our own galaxy and in Messier 33.

The Strömgren theory for the ionization of hydrogen may be applied to a number of these nebulosities and their associated stars. The illuminating stars are mostly B supergiants and their exact spectral types are poorly known. Nevertheless, it is found that the faint rim and arc structures can be interpreted as Strömgren spheres or fragments thereof; in some regions with many knots and condensations the theoretical Strömgren sphere is much larger than the observed nebulosity.

It is suggested that a good fraction of the interstellar hydrogen in the Large Cloud is ionized.

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Hossack, William R. Overly strong hydrogen lines in some late-type spectroscopic binaries.

Overly strong hydrogen lines in some late-type spectroscopic binaries have been discovered in an investigation employing an oscilloscopic microphotometer at the David Dunlap Observatory. The microphotometer has been described by the author.¹ Among other things, the oscilloscopic microphotometer is able to present upon the oscilloscope screen tracings of two stellar spectra, each with its separate amplification control. A method has been developed to obtain rapid estimates of line ratios using this device.

The technique has been applied to classification of late-type stars. Eighty-two spectra of dispersion 33Å/mm, classified visually as K0 and K1, were measured for luminosity. Each criterion gave an independent estimate of the luminosity. Four criteria were employed and these gave an average internal deviation of 0.2 of a luminosity class. The plate-to-plate deviation for different plates of the same star was also 0.2 of a luminosity class on the average. Fifty spectra classified visually as giants, ranging from G8 to K5 were measured for spectral type. Five criteria used gave an average internal deviation of 0.25 of a tenth spectral class. The average plate-to-plate deviation was 0.2 of a tenth spectral class. The precision warrants finer units than those presently employed in the Morgan-Keenan-Kellman system. The improvement, particularly in

the luminosity parameter, should be most useful. Standards could be defined more precisely.

The method has been reduced to a rapid routine, and measures of *I**I* ratios in 800 spectra have been accomplished at a rate of 60 to 70 plates per day. Ten stars were found amongst the 800 with hydrogen lines stronger than to be expected for a star of the spectral type and luminosity indicated by the other criteria. The spectra of these stars appeared not to be composite and five of them turned out to be spectroscopic binaries. The writer has since made an examination of 21 spectroscopic binaries in the G8 to K5 range. All nine with periods exceeding 150 days show no such abnormality. All nine with periods between 15 and 150 days show too strong hydrogen lines. The luminosities of these nine lie between II and III–IV, and their hydrogen lines show no change with phase, either in appearance or in radial velocity, thus agreeing with the metallic lines. Three binaries with periods less than 15 days do not show the effect; it is to be noted that all three are dwarfs. Examples of stars having hydrogen strong spectra are ζ And, HD 213389 and HD 99976. The order of magnitude for stars showing the hydrogen strong effect is sufficient to cause the hydrogen criteria to give classification of a K1 spectrum as G8.

1. *A. J.* **57**, 15, 1952 and *J. R. A. S. Canada* **47**, No. 4.

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Huang, Su-Shu and Otto Struve. A study of Doppler broadening by mass motions.

In mass motion the scales are so large that the equivalent widths of the absorption lines are not affected. The motions under study consist of (1) rotation, (2) random motion of large eddies, (3) tangential motions having a Gaussian distribution of velocities of moving elements, (4) tangential motions having a step-function distribution of velocities of moving elements, (5) vertical motions having a Gaussian distribution of velocities of convective currents, and (6) vertical motions having a step-function distribution of velocities of convective currents. We have computed the line profiles broadened by these motions and found that those broadened by motions (1) and (6) are very much alike, and consequently can not be distinguished.

The spectral lines observed in ρ Leonis shows large-scale motion in the form of either (1) or (6). We group the observed lines in ρ Leonis into