THE LARGE RADIAL VELOCITY OF N. G. C. 7619

BY MILTON L. HUMASON

MOUNT WILSON OBSERVATORY, CARNEGIE INSTITUTION OF WASHINGTON

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Centered around the region at R. A. $23^h\ 16^m$, Dec. $+7°\ 50'$ (1920) is a cluster of small spiral, globular, and elongated nebulae. Two of the brightest nebulae in this group are N. G. C. 7619 and 7626. The first of these is a globular nebula and at the Cassegrain focus of the 100-inch telescope appears visually to be a little brighter than N. G. C. 7626.

About a year ago Mr. Hubble suggested that a selected list of fainter and more distant extra-galactic nebulae, especially those occurring in groups, be observed to determine, if possible, whether the absorption lines in these objects show large displacements toward longer wave-lengths, as might be expected on de Sitter's theory of curved space-time.

During the past year two spectrograms of N. G. C. 7619 were obtained with Cassegrain spectrograph VI attached to the 100-inch telescope. This spectrograph has a 24-inch collimating lens, two prisms, and a 3-inch camera, and gives a dispersion of 183 Å per millimeter at λ 4500. The exposure times for the spectrograms were 33^h and 45^h, respectively. The radial velocity from these plates has been measured by Miss MacCormack, of the computing division, and by myself, the weighted mean value being +3779 km./sec. The velocity of this nebula is, therefore, twice as large as any hitherto observed, the highest previously known being that of N. G. C. 584, for which Slipher obtained +1800 km./sec. Individual velocities from the two plates are +3828 km./sec. for the shorter exposure, and +3754 km./sec. for the longer, which is much the better of the two exposures and is given double weight.

It may be mentioned that Hubble, in a paper in these PROCEEDINGS, gives approximate distances for 24 extra-galactic nebulae, and finds a marked increase in radial velocity with distance. The high velocity for N. G. C. 7619 derived from these plates falls on the extrapolated line which expresses the relationship between line displacement and distance. These results suggest an influence of distance upon the observed line shift—such as would be produced, for example, on de Sitter's theory, both by the apparent slowing-down of light vibrations with distance and by a real tendency of material bodies to scatter in space.

The spectral type of N. G. C. 7619 is estimated as F8, and the probable error of the measured velocity is presumably not greater than 100 km./sec. The large probable error is due to the very poor quality of the absorption lines, but is not of great importance when dealing with such large displacements. The lines are not well defined, being rather wide and diffuse. In

appearance the spectrum is very much like spectra of the Milky Way clouds in Sagittarius and Cygnus, and is also similar to spectra of binary stars of the W Ursae Majoris type, where the widening and depth of the lines are affected by the rapid rotation of the stars involved.

The wide shallow absorption lines observed in the spectrum of N. G. C. 7619 have been noticed in the spectra of other extra-galactic nebulae, and may be due to a dispersion in velocity and a blending of the spectral types of the many stars which presumably exist in the central parts of these nebulae. The lack of depth in the absorption lines seems to be more pronounced among the smaller and fainter nebulae, and in N. G. C. 7619 the absorption is very weak.

It is hoped that velocities of more of these interesting objects will soon be available.

A RELATION BETWEEN DISTANCE AND RADIAL VELOCITY AMONG EXTRA-GALACTIC NEBULAE

BY EDWIN HUBBLE

MOUNT WILSON OBSERVATORY, CARNEGIE INSTITUTION OF WASHINGTON

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Determinations of the motion of the sun with respect to the extra-galactic nebulae have involved a K term of several hundred kilometers which appears to be variable. Explanations of this paradox have been sought in a correlation between apparent radial velocities and distances, but so far the results have not been convincing. The present paper is a re-examination of the question, based on only those nebular distances which are believed to be fairly reliable.

Distances of extra-galactic nebulae depend ultimately upon the application of absolute-luminosity criteria to involved stars whose types can be recognized. These include, among others, Cepheid variables, novae, and blue stars involved in emission nebulosity. Numerical values depend upon the zero point of the period-luminosity relation among Cepheids, the other criteria merely check the order of the distances. This method is restricted to the few nebulae which are well resolved by existing instruments. A study of these nebulae, together with those in which any stars at all can be recognized, indicates the probability of an approximately uniform upper limit to the absolute luminosity of stars, in the late-type spirals and irregular nebulae at least, of the order of M (photographic) $= -6.3$.[1] The apparent luminosities of the brightest stars in such nebulae are thus criteria which, although rough and to be applied with caution,