

sufficient material to form systems more extensive than our solar system.

The paper is illustrated with lantern slides of a few of the nebulae and their spectra.

THE ROTATION AND RADIAL VELOCITY OF THE SPIRAL  
NEBULA N. G. C. C. 4594: *Francis G. Pease.*

A spectrum photograph of this nebula of 80 hours exposure with the 60-inch reflector is approximately of type F5. The slit was set along the major axis of the greatly elongated ellipse which marks the boundary of the nebula—the object is nearly edge-on to the observer. Light was thus received from points at different distances from the nucleus. An extraordinary feature is that the relation between radial velocity and distance is sensibly linear, thus:

$$\text{Velocity} = -2.78 x + 1180$$

in which  $x$  is the distance from the center in seconds of arc.

The radial velocity of the system is accordingly 1180 km/sec., while the rotation velocity at a distance of 2' is 330 km/sec. Assuming the rotational component to be the same as that derived by van Maanen for Messier 101, the parallax is found to be of the order of 0''.0001.

COLOR PHOTOGRAPHS OF NEBULÆ: *Frederick H. Seares.*

Slides are shown illustrating the distribution of color in several of the spiral nebulae. Photographs on ordinary plates compared with others on isochromatic plates exposed behind a yellow filter show that the nuclei are yellow or reddish, while the branches, and especially the condensations scattered along them, are intensely blue and possess a photographic activity similar to that of the central star in the Ring Nebula. The planetary N. G. C. 3242, on the other hand, shows no important differences in the intensity distribution of its blue and yellow light.

SPECTROGRAPHIC OBSERVATIONS OF NEBULÆ AND STAR  
CLUSTERS: *V. M. Slipher.*

The continuation of the spectrographic observations of nebulae and clusters reported upon in 1914, at Evanston, has not—by the inclusion of additional objects—much changed the average radial velocity of 400 km/sec. for the spiral

nebulae. Other spirals have been found to show rotational displacements and several spectrograms of the Great Andromeda Nebula fully confirm the earlier indications of the rotation of this nebula. Some interesting types of nebular spectra have been met with, the most remarkable case being that of the Crab Nebula in *Taurus* in which the chief nebular bright lines seem to be split into two components suggesting the Stark electric field analysis for hydrogen, helium and lithium.

The radial velocity of the globular clusters is less than that of the spiral nebulae and their spectra are blends of early and later type stars with the relative intensities of the types varying from cluster to cluster.

ON THE MOTION OF NEBULOUS FILAMENTS IN N. G. C. 6992:

*C. O. Lampland.*

The intricate structure and definite character of some of the filaments in the nebula N. G. C. 6992 should make it possible to detect comparatively small changes that may take place. Two photographs of this object, separated by an interval of about fourteen years, were examined with a Zeiss comparator equipped with a Blink-Mikroskop. The earlier photograph was a copy on glass of Professor Ritchey's fine photograph of this nebula and the one of later date was from a negative made with the 40-inch reflector of the Lowell Observatory. In the south part of the nebulosity there are apparently slight displacements of small portions of some of the filaments.

VARIABLE STARS IN THE LAGOON NEBULA, N. G. C. 6523:

*C. O. Lampland.*

Four negatives of the Lagoon Nebula, made with the 40-inch reflector in July, 1915, have been examined with the Zeiss comparator and twelve variables have been found in different parts of the nebulosity. Most of these stars are faint, in the neighborhood of the sixteenth and seventeenth magnitude, and as a rule the variation in brightness is small, roughly a magnitude, except for three of the stars where variations from two to three magnitudes are shown.