indicate that, while the frequency of the vibrating light-source varies, the wave-length remains constant. The change of frequency is proportional to the distance of the object. The author has drawn the conclusion that if the red shift were due to a secular variation in the velocity of light rather than to the Doppler effect it should be observable with prismatic spectrographs but not with grating spectrographs.

This conclusion has been criticized by A. Machiels,[1] who points out that an actual difference of wave-length between the lines of the comparison spectrum and those of the distant nebulae should be present, observable with either a prismatic or a grating spectrograph.

A direct observation bearing on this question has been made by us on the bright extra-galactic nebula NGC 4151 which has a spectrum of emission lines. The red shift for this nebula as determined with prismatic spectrographs is well known. In terms of velocity, the Lowell Observatory observations give +980 km/sec; the Lick Observatory observations, +940 km/sec; and some unpublished Mount Wilson measures, +953 km/sec. The simple mean is +958 km/sec. A spectrogram of this object was obtained on April 19, 1935, in the first order of a plane grating spectrograph with a camera having a focal length of 10 inches. The exposure time was about 8 hours. Measures of the two emission lines N1 and N2 give a red shift corresponding to a radial velocity of +962 km/sec, in close agreement with the results from prismatic spectra.

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A SUPER-NOVA IN THE VIRGO CLUSTER

BY EDWIN HUBBLE AND GLENN MOORE

Wolf's nova of 1926, in Messier 61, was the fifth super-nova to be recorded in members of the Virgo cluster during a period of seventeen years. Since the cluster probably had not been observed continuously during that interval, it seemed reasonable

[1] *Zeitschrift für Astrophysik*, **9**, 329, 1935.

to suppose that a careful watch would be rewarded with one super-nova every two or three years on the average. Eventually, it was hoped, a sufficient number would be collected to furnish reliable information on the frequency of these extraordinarily interesting objects. With this end in view, the Virgo cluster has been observed regularly at Mount Wilson since 1928, first by Hubble and later by Baade, with a 10-inch Cooke refractor (F 4.5). The cluster has also been carefully followed during the last few seasons by Zwicky, at the neighboring California Institute of Technology, with a 4-inch camera which would be expected to detect with certainty only the exceptionally bright objects. In the absence of Baade during the current observing season, the 10-inch program has been carried on by the present writers.

The first super-nova to be recorded in the seven-year search was found this season. It is situated about 29″ due north of the nucleus of the late-type spiral NGC 4273. It was first recorded, after an unobserved interval of about sixteen days, with an apparent photographic magnitude slightly brighter than 14.5, and the rate of fading has been so slow that the maximum may be assumed to have been not brighter than 14 (probably somewhat fainter). The absolute magnitude at maximum was thus fainter than -13, and the value -12.5 ($m = 14.2\pm$, $m - M = 26.7\pm$) may be adopted for purposes of discussion.

A 10-inch plate on January 29 confirmed a suspicious image on a plate made January 21, following an unobserved interval of twenty days. The object was too faint to be distinguished with confidence on Zwicky's plates, but a careful study by Zwicky and one of the present writers led to the conclusion that the nova was almost certainly bright on January 18, and probably was not present (or at least not bright) on January 2 (one day later than the 10-inch plate preceding that of January 21). Therefore, the unobserved interval may be assumed as sixteen days.

Owing to cloudy weather or strong moonlight, the nova was not re-observed until February 16, when a plate with the 100-inch telescope, by van Maanen, gave the magnitude as about 15.4. By February 26, it was still brighter than $m = 16$, and

spectra had been photographed by Humason and by Smith. Thereafter the nova appears to have faded rapidly. Dr. Mayall, writing from the Lick Observatory, informs us that by March 3 it was about $m = 17$ or slightly fainter. The data for the light-curve are as follows:

1936	Telescope	m_{pg}	Limiting m
Jan. 1	10-inch	Not visible	17±
2*	4-inch	Not visible	14±
18*	4-inch	Visible?	14.5±
21	10-inch	14.4	
29	10-inch	14.5	
Feb. 16†	100-inch	15.4	
20	10-inch	15.5	
24	60-inch	15.6	
26	10-inch	15.8	

* Plate by Zwicky.
† Plate by van Maanen.

NGC 4273 is classed as Sbc with a stellar or semistellar nucleus in a small compact nuclear region. Stebbins found an abnormally small color-index for the nuclear region, suggesting the presence of emission lines which was later established by Humason. There is some evidence of resolution in the arms—the brightest star (mean of the three or four brightest individual stars) being uncertainly estimated as $m_{pg} = 20.5$. The resulting modulus of the distance, $m-M = 26.6\pm$, is consistent with the assumption that the nebula is a member of the Virgo cluster. The magnitude of the nebula is about $m_{pg} = 12.1$ and, therefore, about two magnitudes or slightly more, brighter than the super-nova at maximum.

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The Spectrum of a Super-Nova in NGC 4273

By M. L. Humason

The nova recently discovered by Hubble and Moore and described by them in the preceding note was bright enough, near maximum, to enable the spectrum to be photographed with