components is relatively small and the exposure average, the calculated values of β fall to zero, as Δm increases, more rapidly than called for by the corrections now in use.

Further observational tests are very desirable, and it is planned to observe a number of selected binaries under widely different seeing conditions and with varying exposures on the photographic plate. Should the predicted variations in blending be found, further experimental work with artificial stars will be undertaken.

I. A. J. 55, 215, 1951.

*University of Florida,
Gainesville, Fla.*

Dyer, E. R. and G. S. Mumford. An unusually blue star in high latitude.

The faint star AC +6°20-62 was observed photoelectrically with the 26-inch refractor of the Leander McCormick Observatory and found to be about 14th photographic magnitude with a color of around -0.71 mag. on the McCormick system or, when an extrapolation is made, -0.6 on the system of Johnson and Morgan.¹ These numbers are only approximate as the star is near the limit of the instrument and is only $1\frac{1}{2}$ from the 6th magnitude dwarf HR 753A. However it appears that this star may possibly be the bluest known.

The proper motion of AC +6°20-62 is $+0".315$ in right ascension and $0".000$ in declination. Although little can be said about the spectrum obtained here with the 10-inch prismatic camera, except that it is continuous, the star is very likely a white dwarf. Dr. H. L. Alden has placed the star on the parallax program, and we hope to be able to determine its distance soon.

I. Ap. J. 117, 313, 1953.

*Leander McCormick Observatory,
University of Virginia,
Charlottesville, Va.*

Hardie, Robert. A photometric study of RR Lyrae.

RR Lyrae was observed photoelectrically in three colors during the summer of 1953. The observations, numbering 1050, were obtained for portions of 12 cycles. The resulting light curves are not found to fit together, even for successive cycles. No phase retardations in the maxima are discernible among the three colors over the cycles studied. It was found that although the blue amplitude is greater than the yellow, the ultraviolet amplitude is intermediate, suggesting a

relatively greater hydrogen absorption during the brightest phases.

Perhaps the more significant features of this star are revealed through a study of the color changes. The $B-V$ color, according to the system of Morgan and Johnson, ranges from 0.44 during the last half of the cycle to 0.18 at maximum light, corresponding to F5 and A7 among main sequence stars. This is in good agreement with Stebbins' color equivalents and confirms his conclusion that the color of this star corresponds to the spectral type characterized by the hydrogen lines, and not to that characterized by the metallic lines. The $U-B$ color reveals that through most of the cycle the star has an ultraviolet absorption similar to that of the giants, but during a short time, as the star is beginning to become bright, the ultraviolet absorption diminishes to make the $U-B$ index temporarily bluer than even the main sequence stars. In the $U-B$ versus $B-V$ diagram the star follows a cyclic path, spending about 80 per cent of the cycle in the giant region and rising above the main sequence very briefly.

It would be of interest to investigate whether this is a characteristic of the RR Lyrae stars in general, since it may provide another criterion for their selection for use in distant systems. It would also be of interest to observe the spectrum during the short time when the ultraviolet is unusually rich.

*Lowell Observatory,
Flagstaff, Ariz.*

Humason, Milton L. Red shifts in faint clusters of extragalactic nebulae.

Red shifts from fifteen clusters of faint extragalactic nebulae are shown in Table I. The largest red shift observed is of the order of $c \, d\lambda/\lambda = 61,000$ km/sec.

In the past red shifts have been termed apparent velocities. This term has now been discarded and replaced by $c \, d\lambda/\lambda$, red shifts expressed on a scale of velocities.

The shifts cannot be distinguished from Doppler shifts. They are constant throughout any given spectrum, within the errors of measurement. If red shifts are Doppler shifts, then a relativistic correction must be applied to the measured values to reduce them to true velocities. This correction is becoming increasingly greater and more important. For $d\lambda/\lambda = 1/5$, the correction would amount to about 10 per cent.

In addition to the results shown in Table I,

red shifts of some 580 extragalactic nebulae have been collected at Mount Wilson and Palomar during the last several years. At the Lick Observatory Mayall has observed the red shifts of some 280 nebulae. Both the Lick and Mount Wilson-Palomar results will be ready for publication in 1954.

TABLE I. RED SHIFTS FROM CLUSTERS OF NEBULAE

Cluster	No. of Neb. Observed	$c \, d\lambda/\lambda$ km/sec
Cl. 1520 + 2754 (a)	8	+21 530
Cl. 1239 + 1852	2	21 580
Cl. 0348 + 0613	1	25 660
Cl. 1513 + 0433	1	28 300
Cl. 1431 + 3146 (b)	2	39 270
Cl. 1056 + 5701 (c)	2	40 770
Cl. 1153 + 2341	2	42 830
Cl. 1534 + 3749	2	45 910
Cl. 0025 + 2223	2	47 620
Cl. 1228 + 1050	2	49 600
Cl. 0138 + 1840	1	51 770
Cl. 1309 - 0105	1	52 460
Cl. 1304 + 3110	1	54 890
Cl. 0925 + 2044	1	57 612
Cl. 0855 + 0322	2	+60 920

(a) CrB, (b) Boo, (c) UMa No. 2.

At the present time all of the uncertainties in the red-shift relation are in the photometry. When reliable magnitudes for the fainter clusters are known, and when the new distance scale is finally established, Hubble's law of the red shifts can be formulated precisely. It may then be possible to say whether or not the red shifts are velocity shifts.

Within the uncertainties of the present magnitude estimates the combined Lick-Mount Wilson-Palomar data confirm the fact that the logarithms of the red shifts, when expressed as $c \, d\lambda/\lambda$, still increase linearly with magnitudes.

*Mount Wilson and Palomar Observatories,
Carnegie Institution of Washington,
California Institute of Technology,
Pasadena, Calif.*

Liller, William. The photoelectric photometry of 18 planetary nebulae.

Because the photographic plate is not well-suited for measuring the brightness of extended objects, the magnitudes of planetary nebulae have never been determined with high precision. The magnitudes of the central stars of these objects are also difficult to measure, since they can never be removed from the abnormally high background fog produced by the surrounding nebulae. Therefore, it is possible to know only

approximately the physical conditions which exist in planetary nebulae.

The brightnesses of eighteen planetary nebulae and the colors and magnitudes of ten of the exciting stars have been determined photoelectrically in order to improve the basic data needed for the interpretation of these objects. The photometer was designed by the writer and was used with both the 24-inch Cassegrain reflector of the McMath-Hulbert Observatory and with the 24-36 inch Curtis Schmidt telescope.

Two techniques were used to measure the nebular surface brightness. In the first method a multi-layer interference filter with a half-width of 35 Å, and a maximum transmission of 81 per cent at 4985 almost completely isolated the usually strong forbidden [OIII] radiations in the green. Small corrections made necessary by the presence of $H\beta$ and the nebular continuum were calculated from earlier measures by Aller, Page, and others. To determine the amount of light from the central star passing through this filter, the spectral region from 45100 to 46000, where the nebular radiations are few and weak, was isolated with conventional filters. From estimates of the colors of the central stars, I was then able to calculate the amount of radiation from the central star passing through the green interference filter. This quantity, when subtracted from the initial measurement, gave finally the deflection from the light of the green [OIII] lines. A comparison of these measures with solar-type stars of known magnitude permitted evaluation of the surface brightness in $\text{ergs cm}^{-2} \text{sec}^{-1}$.

A second method, described by Aller and the writer in the following paper, involves the photoelectric comparison of the nebular spectrum with those of appropriate comparison stars.

A comparison of the surface brightnesses derived by the two independent techniques shows that the nebular brightnesses have been determined with an average probable error of ± 0.07 mag. The photoelectric results indicate that the earlier photographic measurements of the nebular magnitudes made by Berman are systematically too bright by an average of 0.7 mag.

The deflections of the central stars made through the yellow filter and additional measures made through a conventional interference filter centered at 44220 permitted estimates to be made of the colors and magnitudes of the central stars. The magnitudes of these objects published by Berman are in good agreement with these values. Because of the narrowness of the violet