the measured intensities of the Balmer lines can be used as in Zanstra's theory of the planetary nebulae⁴ to determine the total stellar flux in the far ultraviolet to that in the observable region. In the first six nebulae listed above, this ratio ranges from 8 to 28 per cent, figures which should not be strongly affected by interstellar reddening. The average ratio of 18 per cent would correspond to a temperature of about 19,000°K if the spectral energy curve of a nebula were a simple Planck curve, which is of course not the case. However, we may think of the low-temperature energy curve (due to late-type stars) superimposed on an energy curve corresponding to a temperature somewhat higher than 19,000°K.

The shape of the energy curve in the region 0 to 912 Å can also be roughly determined, using the observed ratios of forbidden lines to $H\alpha$, and assuming the former to result only from collisional excitation by hydrogen photo-electrons. The result, expressed as a color temperature, T_{Ly} , in the region of the Lyman continuum, ranges from 13,000 to 25,000°K in the first six nebulae. Correction for interstellar reddening in the nebulae would increase these values.

A tentative conclusion, supported by the consistency of two independent estimates of the far ultraviolet radiation temperatures, is that emission lines indicate the presence in these six extragalactic nebulae of early-type stars which emit radiation below 912 Å equivalent in intensity to some 18 per cent of the total bolometric luminosity. Since early-type stars of high luminosity and interstellar gas are together characteristic of Type I stellar population, the intensity of emission lines can provide a quantitative indicator of the Type I content of a nebula. If so, the purest Type I population among the ten nebulae studied is exhibited by NGC 3077, an irregular nebula in which the far ultraviolet radiation is 28 per cent of the total bolometric luminosity. It also follows from this interpretation that $H\alpha$ emission should always accompany $\lambda 3727$ emission, although $H\alpha$ absorption in the background continuum can mask a faint emission line.

1. *Ap. J.* **108**, 413, 1948.

2. *Ibid.* **102**, 318, 1945.

3. *Ap. J.* **108**, 242, 1948.

4. *Pub. Dom. Ast. Obs.* **4**, 209, 1931.

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Petrie, R. M. A new determination of the mass-luminosity relation from spectroscopic binaries.

This paper presents a new derivation of the mass-luminosity relation from the measured Δm and mass-ratio in ninety-three spectroscopic binary systems. The analysis of the data gives the reciprocal slope of the mass-luminosity relation as $-0.144 + .003 M$, valid from absolute magnitudes $+3$ to -5 .

Using the well determined mass and luminosity of Sirius and the above relation, the mass-luminosity relation from spectroscopic binaries is found to be:

$$\log m = +0.548 - 0.144 M + 0.002 M^2$$

This is listed against eclipsing and visual binaries, not used in the derivation, with satisfactory results over the appropriate luminosity interval. The method is probably worth extending by the inclusion of data both from eclipsing binaries and particularly the visual binary systems.

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Phillips, John G. A comparison of spectra of M-type stars with laboratory spectra of TiO .

An electric furnace, recently constructed at the Yerkes Observatory under ONR contract No. N9onr-87100, has been used to produce the emission spectrum of the TiO molecule at the following three temperatures: 1900°C, 2100°C and 2300°C. Below 1900°C the bands do not appear, and at 2500°C the Swan bands of C_2 become observable. The TiO spectrum from 4000Å to 9000Å was photographed with a grating spectrograph with a dispersion of 50Å/mm.

In addition, the spectrum of TiO , using the high-tension a.c. arc and the same spectrograph, has been obtained for comparison purposes.

The laboratory spectra obtained with these two sources were compared with representative M-type stars. In particular, it was of interest to compare the band profiles of the (0, 0) band of the γ system ($^3\Sigma - ^3\Pi$) at 7054Å which is free of blends in both the laboratory and stellar spectra. The stellar spectrograms were kindly provided by Dr. P. Keenan of the Perkins Observatory. The following stars were chosen: λ Aqr (M2), μ Gem (M3 III), and a long-period variable, R Cas (M6).