ABSTRACTS*

Abt, Arthur. An analysis of W Virginis.†

W Virginis is believed to be a typical population II Cepheid. A study of this star was therefore made to provide a comparison with the classical Cepheids. The data consist of a photoelectric light curve by Kron and Gordon, a photoelectric color curve by Whitford and Code, and spectra of dispersion 10 Å/mm by Sanford and Abt.

The radial velocity curve, derived by R. F. Sanford, is discontinuous. Just before maximum light a set of weak absorption lines appears at -95 km/sec. These lines quickly strengthen with time and move longward. Then they fade and disappear with a velocity of -40 km/sec just after the next light maximum. So for several days around maximum light two sets of weak absorption lines are present.

The radial velocity curve was integrated over time to obtain displacements. These show a symmetrical expansion and contraction with a total displacement of 36 million kilometers, or 50 solar radii. The displacement curve, however, shows an overlap of cycles such that when the upper part of the atmosphere is contracting, the lower part is expanding. The curve suggests that the period of pulsation is twice the period of light variation and the time between pulses is just one-half the duration of one pulse.

The colors were used to derive effective temperatures and bolometric corrections to the light curve. From these we obtained relative radii, which show a radius change by a factor of at least three. However, when the relative radii curve was fitted to the displacement curve to get the scale of the changes, a maximum radius less than the total displacement was derived. The method fails probably because the continuous and line spectra are formed predominantly in parts of an extended atmosphere that have different motions.

Curves of growth indicate that during phases of double lines the excitation temperatures for the shortward components, which are formed lower in the atmosphere, are 800° to 1000° hotter than those for the longward components. The electron pressure reaches a minimum at maxi-

mum expansion. Ionization temperatures were calculated. The various determinations of the temperature at any one phase indicate too large a range for a normal stellar atmosphere; in an extended atmosphere the temperature gradient could be large enough to give the observed temperature range.

The star shows a large spectrum-color difference. The ionization temperatures indicate a range in spectral types from F0 to F8, while the colors correspond to F4 to K2. The largest difference occurs at maximum expansion. The classical Cepheids show no such differences; an unreddened one of the same period would have a spectral type range of F7 to G9. The spectrum-color difference for W Virginis may be due to an extended atmosphere or to the impossibility of using the color-effective temperature relation of population I stars for population II giants.

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Chamberlain, Joseph W. The excitation of the Network nebulae.

It has been proposed that the Network nebulae in Cygnus derive their energy of radiation from an expanding nova shell¹ or, as recent work indicates,² from a shock wave set up by a nova explosion that is moving through the interstellar medium. Presumably, the shock front would generate very high temperatures in the interstellar gas, so that the kinetic energy of the electrons would be sufficient to excite neutral hydrogen atoms by inelastic collisions.

Neglecting the effect of any stellar radiation, but considering electron-hydrogen collisions, we may set up the equations of statistical equilibrium for hydrogen in an optically thin nebula. These equations have been solved in a manner analogous to that used by Menzel and Baker for the case of excitation by stellar radiation.³ The solution gives us values of b_n (the factor inserted in the combined excitation-ionization equation to take account of departures from thermodynamic equilibrium) for all levels $n > 1$. The b_n 's and the Balmer decrement have thus been determined for $T_e = 10,000^\circ$; $20,000^\circ$; and $40,000^\circ$ K. Collisional cross sections obtained from the Born approximation were used in the calculations.

A number of direct photographs of the Network nebulae have been made with the 24-inch,

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