The optimum rate of formation of H_2^+ is obtained if protons and hydrogen atoms are present in amounts of the same order of magnitude. Hence the existence of H_2^+ is practically restricted to the narrow transition zones between the $H\ II$ and $H\ I$ regions of interstellar space, and consequently the formation and decay of H_2^+ should not be of great importance in evaluating the kinetic temperature of the bulk of interstellar matter. Further discussion of the H_2^+ -effect must await completion of the work on the continuous absorption coefficient of this molecule, which is now being undertaken by Prof. Massey and Dr. Buckingham. Transition probabilities and mean life-times for the four lowest vibrational states of the $^3\Sigma_g^+$ level of H_2 have been derived by A. S. Coolidge, H. James and R. D. Present.² A naive application of the Franck-Condon principle would lead to the expectation that a marked transfer of energy from the interstellar radiation field (by the association continuum) to the kinetic energy of the hydrogen gas (by the spontaneous dissociation of the excited triplet molecules) could take place, because absorption of photons would occur on the average at greater nuclear distances (consuming photons of higher frequencies) than re-emission (generating photons of lower frequencies). But the rigorous analysis of Coolidge, James and Present indicates that re-emission from the excited vibrational states occurs predominantly from the outer part of the potential curve, thus producing again high-frequency radiation and low kinetic energy of the receding atoms. Loss and gain of the kinetic energy of the atomic hydrogen appear largely to cancel, and qualitatively one must conclude that the transitory existence of the triplet molecules does not appreciably raise the kinetic temperature of the hydrogen gas. A quantitative test of this surmise would demand laborious numerical integrations for various sets of assumed kinetic temperatures and energy curves of interstellar radiation. It would also be necessary to extend the work of Coolidge, James and Present to the transition probabilities for the higher vibrational states, which are reached by absorption of interstellar radiation of wave lengths shorter than 2000.

Another hypothetical constituent of the $H\ II$ regions are HeH^+ molecules, which could be formed by collisions between protons and unexcited helium atoms. According to quantum mechanical computations these molecules have a stable ground state with a dissociation energy

of 1.1 volt,³ and in fact they have frequently been observed in the mass spectrograph. By capture of an electron HeH^+ would dissociate, as the ground state of the neutral helium hydride is unstable. No spectrum of HeH^+ has so far been observed in the laboratory, and little is known about the theoretical energy level diagram.

1. *Ap. J.* **107**, 6, 1948.
2. *Phys. Rev.* **55**, 184, 1939.
3. S. Toh, *Proc. Phys. Math. Soc. Japan* **22**, 119, 1940.

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Williamson, Ralph E. and G. F. D. Duff. On the role of the guillotine factor in stellar structure.

Integration of five point-source models for late type main sequence stars have been performed, the guillotine factor being taken to vary with different powers α of the density. Certain transformations of the equilibrium equations into a form convenient for numerical work are given. The central conditions and chemical compositions of late-type main sequence stars, on the basis of these models, are found to depend sensitively upon the representation of the guillotine factor; for this reason no definitive conclusions regarding them can be drawn from these models. Indications are that values of $\alpha \approx 0.50$ are suitable, and that central temperatures are slightly lower, and densities noticeably higher, than the Cowling model. The carbon cycle is probably the predominant source of energy, and on this basis, it is found that hydrogen and helium contents are rather higher than those indicated for the sun. Suggested refinements to the models are representation of the guillotine factor proportional to two different powers of the density in the inner and outer portions of the radiative envelope, and allowance for deviations from the perfect gas law due to degeneracy.

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Wood, Frank Bradshaw. The eclipsing variable, RX Herculis.

The variability of RX Herculis was discovered by Sawyer in 1898. Since then, it has been observed visually, photographically, and spectrographically; this is the first photoelectric study. This study is based upon 323 photoelectric observations taken in the summer of 1947 with the 12-inch refractor of the Lick Observatory and a photomultiplier photometer constructed by G. E. Kron.

The observed minima occurred about 15 minutes earlier than the times predicted from Shapley's light elements. New light elements have been determined as Pr. Min. = JD 243 2380.7145 + 1^d7785720 E. There is no definite evidence of any change of period. Secondary minimum is displaced forward on the curve by 0^d0020. Although this displacement amounts to only three minutes, the shape and depth of the minima and the precision of the observations make it easy to detect. The secondary minimum is also slightly wider than the primary.

The initial plot of the observations showed two well-separated minima and an asymmetric light-curve between them. The asymmetry amounted to several hundredths of a magnitude; the observations near first quarter were actually lower than those just outside of primary, while those at third quarter were distinctly higher. A study of the magnitude differences between the comparison star and the check star on different nights suggested a variation in one of these. When the measures of the variable were reduced to the check star, the asymmetry of the light-curve disappeared almost entirely. There is thus evidence to indicate that the star used as comparison, BD +12°3546, varies over a range of at least 0.04 mag. Fortunately, the nightly use of a check star made it possible to remove from the curve the effects caused by the variation of the comparison star. When these corrections are made, the probable error of an individual observation from the theoretical curve is ± 0.007 mag.

The displacement and the broadening of secondary indicate that the orbit is eccentric. Because of the difficulty of separating the spectra of two similar stars of comparable brightness, this eccentricity has not been detected spectrographically. It is thus necessary to determine it photometrically without help from the spectrographic orbit. Fortunately, this can be done in the present case. The component, $e \cos \omega$, is of course determined from the secondary displacement. Further, the secondary is sufficiently deep and well observed to permit an independent determination of the elements from it. Comparison of these with the elements determined by the solution of primary gives the component $e \sin \omega$ and the true elliptic elements. The eccentricity is found to be small, < 0.02 . It is of interest to note that this is one of the few cases where the eccentricity can be determined photometrically and not spectrographically.

The principal elements of the system are:

α_0^{tr}	0.916	r_b	0.232, 2.26 $\odot$
α_0^{oc}	0.939	r_f	0.188, 1.83 $\odot$
k	0.810	m_b	2.1 $\odot$
i	85°6	m_f	1.9 $\odot$
L_1	0.636	ρ_b	0.18 $\odot$
e	0.018	ρ_f	0.31 $\odot$
ω	95°5		
J_1/J_2	1.1		

The absolute dimensions were computed with the aid of Sanford's¹ spectrographic elements.

In conclusion, an indication of the determinancy of the results is in order. While the above elements give the best fit to the observations, other solutions were tried in order to see how much the elements might be varied and still give an acceptable fit. The permissible variations were found to be slight. For example, the greatest permissible changes in depths and shapes of minima yield a change of only 5 per cent in the computed radii; the greatest value of the inclination thus found, combined with the spectrographic elements still yields a mass of 2.1 $\odot$ for the larger component. Another solution assuming 0.4 for the degree of darkening makes even a slighter change in the final elements.

1. *Ap. J.* 68, 51, 1928.

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Yu, Ch'ing-Sung. Notes on a possible photometric effect from Struve's theory of whirlpools around binary systems.

Struve's recent theory of revolving streams around binary stars, which has been amply supported by spectroscopic evidences, appears to receive an additional proof from a photometric effect observed in the light curve of an eclipsing binary. In his photometric study of CG Cygni, the writer noted in 1922 that the total light of the binary at phase 0^P.25 is greater than that at phase 0^P.75 by 0.045 mag. This was at first puzzling, since at these two positions, the components are symmetrically identical and therefore the brightness of the system should remain the same. However, it seems an explanation can be obtained now if we assume, following Struve, that the system is surrounded by a whirlpool ring of gas. The portion facing the observer at 0^P.25 is hotter, according to the theory, than that at 0^P.75, giving rise to the slight difference in magnitude. It is pointed out that for CG Cygni a difference of 100°K is sufficient to account for the discrepancy. Reasons are given to explain the lack of similar observations so far, but sugges-