10,000° to 50,000° for an idealized helium atom consisting of a continuum and 1S level and the levels 2S, 2P, and $n = 3, 4$ and 5 in the excited singlets and triplets.

Computed and observed values of $b_n \exp[\chi_n/T_e]$ for the triplets agree for all T_e even though b_n varies with T_e . The relative populations of the triplets are determined almost entirely by the radiative transitions, which, because of the low chromospheric opacity in the triplets, are independent of the ambient T_e .

For the singlets, however, the occupation numbers of the excited levels depend critically upon R_n , the net radiative transition rates to the ground state, which are functions of τ_0 , the chromospheric opacity in the first resonance line. Thus, both T_e and τ_0 are parameters of the calculations, with τ_0 , in turn, being a function of T_e and n_e . The electron density, n_e , may be estimated from the absolute line intensities. In order to relate R_n to τ_0 , we use the source-function computations of Jefferies and Thomas (1959).

Computed values of $b_n \exp[\chi_n/T_e]$ and τ_0 for the singlets agree satisfactorily with the empirical $b_n \exp[\chi_n/T_e]$ for $T_e \approx 40,000^\circ$ – $50,000^\circ$. Uncertainties in atomic constants and R_n may permit a T_e as low as 30,000°, but certainly not as low as 25,000°. At chromospheric densities, helium becomes predominantly HeII at $T_e \approx 20,000$, and predominantly HeIII at $T_e \approx 55,000^\circ$. Chromospheric helium is, therefore, predominantly HeII as suggested earlier by Athay and Menzel (1956).

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Keenan, Philip C. *Absolute magnitude of the Mira variable X Monocerotis.*

The sharpness of the stellar absorption lines in the spectra of the Mira variables allows their interstellar D-lines to be observed if their peculiar radial velocities exceed 30 to 40 km/sec. X Mon is a particularly favorable case, since it has $V_r' = 142$ km/sec and is located at galactic latitude -1° . The observations of X Mon (type M3e at maximum, $P = 155$ days) were made near maximum light on a scale of 15 Å/mm with the coudé spectrograph of the Mount Wilson 100-inch telescope. Because of blending of inter-

stellar D₁ with Ni 5892, only D₂ could be measured, giving $W = 0.26$ Å and $V' = +10$ km/sec for the interstellar component.

Four A- or B-type comparison stars within 1° of the variable all proved to have stronger interstellar lines than those of the variable. This made necessary an extrapolation which reduced the accuracy of the determination of distance. The estimated values for X Mon are $M_v = -0.7$, $d = 350$ pc.

This luminosity is lower than the mean values generally estimated from the motions of the Mira variables of shorter period. The difference is probably real, for classification of its spectrum in the blue indicates that X Mon is one of the least luminous of the Mira variables.

In another respect also, X Mon is atypical, for its mean visual amplitude is only 1.8 magnitudes. Nevertheless, it should probably be retained among the Mira variables, for X Mon is normal in the strength of its Balmer emission and in the degree of weakening of the stellar absorption lines in comparison to ordinary giants.

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*Perkins Observatory
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Kerr, Frank J. *The integrated brightness approach to 21-cm galactic studies.*

The interpretation of 21-cm observations in the region of the galactic disk has so far been based on a consideration of the detailed structure of line profiles. This work has led to representations of the spiral structure and the three-dimensional shape of the Galaxy, but the interpretation is dependent on assumptions about the rotational and random motions at various distances from the galactic center.

A number of interesting results can be obtained from a study of the "integrated line brightness" for each direction in the sky, without the need to derive a distance scale from an assumed rotation curve. The picture which is obtained from the profile details must then be compatible with the integrated brightness results. Also, comparisons can be made directly with the distribution of the continuum radiation at various wave lengths.

Two determinations can be made of the apparent direction of the galactic center, the first from the variation of integrated brightness

with longitude, and the second from a comparison between the positive and negative portions of the integrated profiles. These indicate that the mass and velocity distributions of the neutral hydrogen are both approximately symmetrical about the direction for the center which is obtained from other evidence. Further, the integrated brightness results lead to a more reliable rotational velocity model, which is based on a larger region of the Galaxy than has been used for earlier models, and involves only the assumption that the Galaxy is rotationally symmetrical when viewed on a large scale.

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Koch, Robert H. *Photoelectric photometry of R Canis Majoris.*

Yellow, blue, and violet photoelectric light curves of R CMa were obtained at the Steward Observatory. At each wave length the maximum following primary eclipse does not show the expected ellipticity and reflection effects. Within eclipse a common solution for 0.8 limb darkening fits the observations satisfactorily. This solution differs from three previous ones in a manner which gives a spuriously large relative size for the hot star. The physical mechanism causing this discrepancy is unknown. The remaining elements are much the same as those found earlier and can be considered well-determined.

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Kozai, Yoshihide. *On the motion of a close earth satellite.*

Perturbations of six orbital elements have been derived as functions of mean orbital elements over all the period and a time, with no assumption about an order of magnitude of an eccentricity and an inclination. The assumptions employed were that the density distribution of the earth is symmetrical with respect to the axis of rotation, that the coefficient of the second harmonic of potential is a small quantity of the first order and that the coefficients of the third and fourth harmonics are of the second order. My results include periodic perturbations of the first order and secular variations up to the second order.

However, the solutions have some singularities for an orbit whose eccentricity or inclination is

smaller than a quantity of the first order, so this case is treated in a different way.

A theorem is demonstrated that there are no long-periodic terms of at least the first order in the expression of the semi-major axis by using Delaunay's canonical elements.

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Kraft, Robert P. *Intrinsic colors for cepheids and late-type supergiants derived from interference filter photometry of the G-band.*

Using narrow-band interference filters, an index Γ , which measures the strength of the G-band, has been obtained for a number of Cepheids and for supergiants from F2 to K0. A good correlation is found between Γ and spectral type from F5 to G4. Measurements of Γ have also been made during the entire cycle of the Cepheid U Sgr, and at isolated phases of EV Sct and δ Cep; intrinsic colors are known for these Cepheids because of companions or membership in an open cluster (Irwin 1958, Arp 1958, Gascoigne and Eggen 1957). It is therefore, possible to correlate Γ with $(B-V)$. The variability of spectra type for Cepheids during a cycle permits the derivation of intrinsic colors for class Ib and II stars from F5 to G4.

At F5 Ib, the $(B-V)$ colors of Cepheids agree with that of α Per (Harris 1956). Color excesses and distances are given for a number of summer Cepheids.

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Krogdahl, W. S. *Analogies between self-excited systems and intrinsic variables.*

The simplest self-excited systems of the Van der Pol type may be classified according to their respective excitation and damping parameters. A sequence of their limit cycle solutions displays properties which exhibit qualitative analogues of the properties of the sequence of intrinsic variables arranged in order of period.

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