In the Large Cloud the distribution of the gas has been found to be similar to that of the stars, but in the Small Cloud an envelope of gas extends well beyond the central core of stars. The stellar population of the Large Cloud appears from optical studies to be nearly pure Type I, while Gascoigne and Kron believe that the Small Cloud is predominantly Type II. Thus a picture is suggested in which the gas in the Large Cloud is intermixed with dust and Type I stars, while in the Small Cloud it is mainly outside a core of Type II stars, and no dust is present.

In the face-on view, the Large Cloud is more irregular than the Small Cloud. In addition, information about the gas distribution in depth can be obtained from the line profiles. The Large Cloud is inferred to be an irregular and flattened system seen face-on, a description which is consistent with its Type I population. The Small Cloud is more regular in form, and is probably nearly spheroidal, except for a protuberance, perhaps drawn out gravitationally, in the direction of its more massive neighbour.

The distribution of radial velocities over the whole of the two Clouds has been obtained. Analysis of the mean radial velocities, derived from the line profiles, indicates regular motions of (1) rotation as a binary system and (2) translation.

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Kiess, C. C. Neutral and ionized zirconium in stellar atmospheres.

Recently, at the National Bureau of Standards the spectra emitted by zirconium ions have been measured in the region from 500 A to 10,000 A. For the spectrograms covering the vacuum region we are indebted to Prof. A. G. Shenstone of Princeton University. The new wave lengths have led to revisions and extensions of the energy-level structures of *Zr* II, *Zr* III, and *Zr* IV. Nearly all the new lines of these spectra have been classified as transitions between known and the newly discovered energy levels of singly, doubly, and trebly ionized *Zr* atoms.

In *Zr* II about 75 new lines have been measured between 4800 A and 10,000 A, of which about 10 per cent agree with unidentified solar lines. The new lines of *Zr* III and *Zr* IV, about 200 in all, lie in the ultraviolet beyond the reach of astronomical spectrographs. In each ion, however, new energy levels have been found with which one may calculate accurately the wave lengths of high-excitation lines that are likely to occur in the hotter stars and that are accessible to astronomers. The extensive lists of stellar lines, published by various observers for stars of classes B to M, and Novae, contain many identifications ascribed wholly or partially to neutral and singly ionized *Zr* atoms. To establish the identifications correctly not only is agreement between laboratory and stellar wave lengths necessary, but also consistency of behavior of the identified lines relative to the associated lines in the multiplet or super-multiplet to which they belong. The energy-levels now available for the first four spectra of *Zr* make it possible to test the multiplet relationships of all lines of this element that are likely to be of astrophysical importance.

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Kopal, Zdeněk. The interpretation of eclipses of ε Aurigae.

The forthcoming minimum of ε Aurigae in the years 1955–57 once more attracts attention to the peculiar nature of eclipses of this remarkable binary system. An inspection of its light curve discloses that the minima, which recur every 27 years and last over 700 days, are due to total eclipses of its principal cF5 component undergoing obscuration by an invisible companion which must, moreover, be semitransparent; for the light of the F star is seen to shine through during the entire cycle, and to get merely dimmer by about 0.8 mag. during minima. Heterochromatic observations reveal, furthermore, that this obscuration remains sensibly the same in the light of any color. In order to account for these facts, Kuiper, Struve, and Strömgren suggested in 1937 that the secondary component—too cool to be seen in its own light—may be surrounded by a relatively dense layer of free electrons (liberated by the ionizing effect of the radiation of the F star). This layer eclipses the principal component within minima; and its scattering effects produce the non-selective opacity.[1] This explanation appears, however, to meet serious difficulties in regard to the radiative properties of the F star, and to the observed constancy of light during totality.

In order to avoid these difficulties, the writer proposes a tentative hypothesis suggesting that the eclipses of the principal component of ε Aurigae are caused, not by a shell of ionized matter, but more likely by a flat ring of solid particles surrounding the secondary component and inclined to the plane of the eclipsing orbit. Such a ring may well be semi-transparent; and an eclipse by it should be capable of producing a perfectly flat minimum. Moreover, if the particles constituting it are large in comparison with the wave length of visible light, an extinction caused by them should indeed be non-selective. On any plausible assumption as to the probable size of such particles and their composition, the mass of a ring adequate for producing the observed minima should be between 10^{27} and 10^{28} g. As to the secondary component itself, we seem to know virtually nothing about it save that its mass must be comparable with that of the principal component (and, therefore, probably quite large), and that its effective temperature must be low enough—probably less than a few hundred degrees K—to enable it to escape detection by lead-sulphide cells.

1. *Ap. J.* **86**, 570, 1937.

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McDonald, Jean K. Electronic computing machine methods applied to the problem of model stellar atmospheres.

Making use of the Ferranti electronic computing machine of the McLennan Laboratory of the University of Toronto (FERUT), it has been possible to undertake an improved method of constructing a model of a non-grey stellar atmosphere, that employs the variational method for solving the integral equation for the source function. The monochromatic source function is represented by an expansion in terms of the exponential integral functions, and the integration with respect to frequency of the equation representing the monochromatic flux in terms of these functions provides for each value of optical depth in the atmosphere an equation that expresses the constancy of flux as a minimum condition. This set of equations, combined with the equations representing the radiation at any optical depth, may be solved by least-squares procedure to provide an improved temperature-depth distribution that may be expected upon repetition of the process to converge to a distribution that ensures a constant flux.

In the course of the investigation of early-type models at present under way, tables have been prepared for publication, of the Planck function and of the absorption coefficient for a pure hydrogen atmosphere, for sixty-four values of frequency in the range 100A to 25,000 A and of one hundred and four values of temperature in the range 15,000° to 50,000°K.

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McLaughlin, Dean B. The Orion absorption spectra of two novae.

Orion spectra have not been reported previously for the two novae discussed here.

Nova V 528 Aquilae (1945). This nova reached magnitude 6.9 at maximum on August 26 and declined 3 mag. in 35 days. Secondary oscillations though small were probably real. Observations beginning August 31 showed a normal and smooth spectral development. Velocities of principal and diffuse enhanced systems are given in Table I.

TABLE I. NOVA AQUILAE 1945: ABSORPTION VELOCITIES (KM/SEC)

Date, UT	Principal		Diffuse enhanced	
	II_1	II_2	III_1	III_2
Aug. 31	−1135	....	−2040	....
Sept. 5	−1180	−1370	−2085	−2280
12	−1210	−1460	−2215	−2520
20	−1270	−1555	....	−2635:
Oct. 2	−1250	−1630	....	....

Weak Orion lines first appeared Sept. 4. By Sept. 12 several lines were present, but on Sept. 21 the Orion system suddenly developed maximum strength which lasted, with variations, until Sept. 30, then rapidly weakened. Numerous lines of *He*I, *O*II, and *N*II were present, but *N*III was not surely recorded and no "nitrogen flaring" was observed. Velocity was about −2500 km/sec with slight changes until Sept. 17, but individual lines were discordant. Oscillations then set in, as shown in Table II. Such oscillations characterize Orion spectra of novae that have large secondary light variations, but it is remarkable to find them associated with a fairly smooth decline. Nevertheless, the changes, Sept. 24–27, anticipated by a few days a small but definite brightening. Similar correlations have been noted in other novae. CP Lacertae 1936, with a smooth decline, also had an Orion spectrum that oscillated strongly.

TABLE II. NOVA AQUILAE 1945: ORION VELOCITIES (KM/SEC)

Date, UT	Velocity	Date, UT	Velocity
Sept. 17	−2485	Sept. 25	−2505
18	−2675	26	−2295
19	−2600	27	−2160
20	−2570	30	−2285
21	−2460	Oct. 2	−2280
24	−2745		

Nova V 450 Cygni (1942). This star of Nova Herculis type was discovered nearly 3 months