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 Å to 10,000 Å. 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 Å and 10,000 Å, 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