to one designed by H. L. Johnson, and it is possible to measure the intensity of an emission line having a brightness equivalent to a 20th magnitude star when the instrument is used at the focus of the 24–36 inch Curtis Schmidt.

The observations were made during the early months of 1956 with the monochromator mounted at the Newtonian focus of the Curtis Schmidt. All spectral traces were of a region 15" east of the Trapezium.

Our observed line intensities for the Orion Nebula are, for the most part, in excellent accord with those given by Wyse. We find the electron temperature, estimated in the usual way from the $4363/(N_1 + N_2)$ ratio, to be 9600°K, somewhat lower than that found using Wyse's measures. The space absorption can be estimated by comparing Balmer and Paschen lines that originate from the same higher level, provided that the Balmer lines are not affected by self-reversal. However, further observations are needed to establish more accurately the intensity ratio of $H\alpha$ to $H\beta$. The intensity measures of lines of [SII] and [OII] permit an estimate of the electron density, and we find it to be in the vicinity of 7×10^3 electrons/cm³. It is of interest to note that the [SIII] nebular lines at 9069Å and 9540Å are the second strongest forbidden lines in the nebula. We have estimated that the relative abundance of sulphur atoms in the nebula is some seven times greater than in stars. Other atomic and ionic abundances have been calculated, and the results will appear elsewhere.

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McKellar, Andrew. The ultraviolet chromospheric spectrum of ζ Aurigae at the 1955–56 eclipse.

With new adaptations of the Victoria stellar spectrograph, it is possible to photograph to the limit of atmospheric transmission near $\lambda 3000$. At the time of the recent 1955–56 eclipse of ζ Aurigae, a number of spectrograms of the ultraviolet region were obtained by various staff members. Among the points of interest revealed by these plates are:

- (1) The onset of totality occurred at about the right time, but perhaps a fraction of a day later than predicted.
- (2) A week before totality over 50 chromospheric lines representing seven multiplets of TiII, five multiplets of FeII and four multiplets

of CrII could be measured between $\lambda 3100$ and $\lambda 3440$.

(3) The mean radial velocity given by these lines was about 6 km/sec. more positive than the radial component of orbital motion.

(4) Fourteen days after totality, a good number of these chromospheric lines of the ionized metals remained and the strongest of them were comparable in intensity with the K line of CaII.

(5) At both ingress and egress, the height of the chromosphere of the K-type supergiant star was "normal," not the much more extreme value sometimes found for this star.

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McLaughlin, Dean B. Possible condensation clouds over Martian volcanoes.

An unusual Martian cloud, observed in 1954 by Pettit and Richardson (1955), had the form of a letter "W," with dense knots at ends and junctions of the strokes. The strongest knot was at longitude 120°6, latitude –10°8. They called attention to an apparent association of the knots with oases. Some of the cloud knots, including the strongest one, were found near the same locations at two times a month apart. Slipher's observations (Sinton 1955) showed that they disappeared at night and re-formed each afternoon.

I am much indebted to O. H. Truman of Hollywood, Calif., for making available photographs he took in 1941 with the 100-inch telescope. One in blue light, August 18, 11^h48^m UT, shows a cloud 10° in diameter near the terminator, with center at longitude 115°8, latitude –17°0, near Phoenicis Lacus. A tail extends to longitude 103°5, latitude –6°2, near Tithonius Lacus.

Clouds in the same small area were photographed in 1939 by Wright (1939) and in 1926 by Ross (1926) and Wright (1927). The center of the cloud of 1926, October 14–18 was at longitude 120°8, latitude –12°6. Thus, on four occasions over an interval of 28 years, unusual clouds have appeared in the same small area. On the last occasion they formed repeatedly about the same place. A mechanism associated with a fixed location on the planet's surface is indicated. Condensation of moisture from air currents rising along a mountain front is improbable, in view of the lack of mountain ranges on Mars. Condensation of moisture issuing from volcanic vents is suggested as a working hypothesis.

The region of cloud formation is also one in which great changes have occurred on the surface. The "horn" of Phasis in 1877 had its vertex at Phoenicis Lacus. In 1926 the Solis Lacus was distorted by a new marking that appeared to fan out from a spot in Tithonius Lacus. These can be explained as ash falls from eruptions at those spots (McLaughlin 1955). The coincidence of an area of recurrent cloud formation with one of strong surface change is too close to be dismissed as accidental. Volcanism is an adequate explanation of both the superficial and atmospheric phenomena, and of their association.

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McVittie, G. C. On the formation of a star.

The problem investigated is that of the collapse of an isolated spherical cloud of interstellar gas; the cloud has initially a diameter of some parsecs and a mean density of from 10^{-18} to 10^{-24} g/cm³, and finally becomes an object of stellar dimensions and density. The forces acting are assumed to be the pressure-gradient force and the gravitational self-attraction alone; viscosity, radiation-pressure, centrifugal force, etc., all being neglected in comparison. The equations governing the motion are the hydrodynamical equation of motion and the equation of continuity, but the motion is assumed to be non-adiabatic so that each gas element loses heat energy as it moves. This loss of energy is presumed to take place by the emission of radiation which escapes from the sphere of gas. The first law of thermodynamics provides a formula for calculating the rate of loss, "following the motion" of each unit mass of gas.

The boundary and initial and final conditions are these: at the boundary the pressure and density are always zero and the gas-velocity is equal to the velocity of the boundary; initially, the gas is at rest but not in equilibrium and each of its elements has an inward acceleration; finally, the gas is at rest and also in equilibrium. This final state is assumed to be a complete polytrope.

The equations of motion and of continuity can be solved exactly for the pressure and density under the assumption that the velocity q of the gas is given by the linear-wave rule, viz.

$$q = \frac{1}{f} \frac{df}{dt} r, \quad (1)$$

where f is an arbitrary function of the time t and r is distance from the center. The solution, however, involves a second arbitrary function h of the variable r/f . It is proved that h can be determined in terms of the Emden function which describes the complete polytrope giving the final equilibrium state. The initial and final conditions, though they impose certain restrictions on f , do not define this function completely which means that the gas-sphere can collapse to stellar dimensions in a variety of ways. Each of these ways, however, gives rise to different ways of emission of energy. A lower limit for the time of collapse can be calculated and a specific model, having a specific expression for f as a function of t , indicates that this time varies from 10^5 to 10^8 years according as the initial mean density is 10^{-18} to 10^{-24} g/cm³. The initial central temperature of the gas sphere can also be calculated and turns out to lie between 50° or 80° and 1° absolute, according as the mean density lies between the limits quoted and the mass of the sphere is 5 or 10 times that of the sun. Various ways of avoiding this low-temperature difficulty are discussed, one of which is that the final equilibrium state might be taken to correspond to an Emden function with a singularity at the origin.

The total emission of radiation during the collapse is calculated and shown to be equivalent to a small loss of mass for the gas-sphere, smaller than occurs, for example, in a nova outburst. The final rate of emission of energy from the surface of the star is also found to be small relative to the luminosity of the sun. These two results are to be expected because radiative processes have not been taken into account in the theory.

The investigation is intended to show how an interstellar gas-cloud could form a star, and not how it must do so, by tracing out the whole development of the motion from start to finish using the exact theory of gas-dynamics and gravitational theory. The work was done as part of a project sponsored by the National Science Foundation.

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Meltzer, Alan S. The red spectrum of Algol at primary minimum.

Three 100-inch coude spectrograms in the region $\lambda 5800$ – $\lambda 6700$ were obtained of Algol at