effect, the asymmetry between the descending and ascending branches of the light curves, the smaller variation of the light intensity during total eclipse and the small discrepancies with respect to eccentricity between photometric and spectroscopic orbits.

I. A. Van Hoof, Bijdrage tot de berekening van de photometrische baan van eclipsvariabelen, *Med. Kon. Vlaamsche Acad. Belgie*, 6, No. 4, 1944.

*Louvain University,
Belgium*

Whipple, Fred L. The orbits of meteors photographed at two stations.

The orbits of 45 photographic meteors have been determined with considerable precision by means of the two-station rotating-shutter method at stations of the Harvard Observatory. Seven showers are represented by 28 meteors (62 per cent) in all; 9 meteors (20 per cent) are sporadic; and 8 meteors (18 per cent) are uncertainly associated with showers.

All orbits can be accepted as elliptical within the uncertainty of measurement.

All orbits with aphelion distances less than 11 a.u. (67 per cent) are inclined less than 30° to the ecliptic (mean $i = 11^\circ$) while all but one longer orbits have very high or retrograde inclinations (mean 124°). No significant differences between the average shower and sporadic meteors are evident in the distributions of a , e , and i .

When meteor frequencies are corrected for the now-verified relation among luminosity, mass and velocity, it is found that about 90 per cent of all the doubly-photographic meteors of a constant mass travel in direct orbits with $i < 35^\circ$, and about 1 to 2 per cent in orbits with $i > 145^\circ$. The frequency dependency on i is much the same for the visual showers observed by Öpik (Watson parabolic orbits), and for the fireballs of the Von Niessl and Hoffmeister Catalogue (Watson parabolic orbits). The distribution for periodic comets observed at two or more oppositions is similar, but more comets, as expected (19 per cent), are found in the range $35^\circ < i < 145^\circ$, and for $i > 145^\circ$ (3 per cent).

Also a remarkable orbital similarity between the four asteroids with $q < 1$ a.u. and the six sporadic meteors with aphelion < 5 a.u. is evident on comparison of the mean elements a , e , q , and i . On the other hand, the mean aphelion distance and scatter in e are much larger for these meteors.

As a working hypothesis the writer prefers to associate all or nearly all of the photographic and

brighter visual meteors generically with comets rather than with meteorites and asteroids. This preference is based upon (a) Many cases of obvious association, (b) Similarities in orbital characteristics among sporadic meteors, shower meteors and short-period comets, (c) The fact that meteorite falls suggest little or no shower association, (d) Selective elimination of small asteroidal particles and separation of smaller particles from older showers by the Poynting-Robertson effect and by other likely forces.

*Harvard College Observatory,
Cambridge, Mass.*

Wright, K. O., and Elsa van Dien. The spectrum of ϵ Aurigae, 1946-48.

The spectrum of ϵ Aurigae has been studied in the region $\lambda\lambda 3700-6800$ and compared with that of α Persei; a grating spectrograph was used which gave dispersions of 7.0 and 4.6 Å/mm in the second and third orders respectively. In $H\alpha$, emission edges appear on each side of the absorption line and seem to be variable. Of other light elements, lines of Cr and Or are definitely present, and Ni is probably present in this region; lines of Sr are weaker than in α Persei.

The great breadth of the lines permits a study of their profiles. In the region near 5400 Å, all lines appear to have the same shape and fit a Gaussian curve for a velocity of 33 km/sec reasonably well. As this velocity is considerably greater than that found from the curve of growth, it is suggested that the lines are produced by turbulent motions combined with a rotational velocity less than 30 km/sec or additional jet motions of the same magnitude.

Curves of growth were drawn for Fe I lines after they had been separated according to excitation potential in small ranges from 0 to 4.5 volts; $\log W/\lambda$ was plotted against empirical solar $\log X_f$ -values and these data were compared with theoretical curves based on the Milne-Eddington model. No single theoretical curve can be made to fit the observations and it is suggested that a turbulent velocity decreasing with increasing excitation potential may explain the phenomenon; the results are similar to those found previously for α Persei but the range is greater.

The Fe I lines were also separated into "normal" and "metastable" levels in a search for dilution effects in the atmosphere but no positive results were noted.

*Dominion Astrophysical Observatory,
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Wright, Frances W., and Fred L. Whipple.
Photographic meteor results for the month of October.

In the month of October from 1891 through 1947, 147 meteors (179 trails) have been photographed on Harvard plates. Measurement of these trails permits identification of 46 per cent of the meteors as belonging to showers and 54 per cent as sporadic. Miss Wright has discovered a new shower active from October 2 to 10 with maximum on October 6, represented by 9 to 10 meteors. The apparent radiant is at $\alpha = 355^\circ.6$ and $\delta = +10^\circ.1$ (1950.0). Analysis shows that the velocity is probably fairly large since there is no evidence for a large zenith attraction.

The Orionids account for 20 per cent of the October meteors. The shower is photographically active from October 17 to 26 with maximum on October 22, in agreement with the visual observations. The daily motion of the Orionid radiant is found to be $43'$ per day, nearly parallel to the ecliptic. On October 22 the corrected radiant is at $\alpha = 94^\circ.2$, $\delta = +15^\circ.8$ (1950.0). An average extended single trail misses the calculated radiant by a probable error of $\pm 23'$. No evidence for the multiple Orionid stream derived by J.P.M. Prentice was found, but his predicted daily motion of the radiant is in close agreement with the observed one. Two-station photographs leading to velocities for two members of the Orionid shower are not of high quality. An identification of the shower with Halley's comet remains reasonable but unproven.

The Taurid meteor shower is represented by 17 per cent of the October meteors fairly uniformly distributed from October 14 on into November. Two other small showers are represented only by single questionable members in October.

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 Cambridge, Mass.*

**TITLES OF ADDITIONAL PAPERS PRESENTED
 AT THE MEETING IN PASADENA, CALIF.**

Bowen, Ira S. Introductory Remarks on the 200-inch telescope. See *Pub. A.S.P.*
 Anderson, John A. Optics of the 200-inch telescope. See *Pub. A.S.P.*

Rule, Bruce H. Mechanics of the 200-inch telescope. See *Pub. A.S.P.*

Baade, Walter. Program of the 200-inch telescope. See *Pub. A.S.P.*

Adel, Arthur. The carbon dioxide bands between 2 and 5.5 microns in the grating solar spectrum.

Aller, Lawrence H. The collisional excitation of wave length 3727 (O II) in the planetary nebulae. See *Pub. A.S.P.*

Babcock, Harold D. A study of the sun's general magnetic field. See *Pub. A.S.P.*

Babcock, Horace W. Magnetic intensification of Fraunhofer lines. See *Pub. A.S.P.*

Gaposchkin, S. I. Note on three eclipsing systems.

Harrison, Jorie H. On the chemical composition of the sun from its internal constitution.

Herbig, G. H. The irregular variable RW Aurigae and related objects. See *Pub. A.S.P.*

Herrick, Samuel. A modification of the "variation-of-constants" method in special perturbations. See *Pub. A.S.P.*

Hesthal, C. E. Interference type reflection filters for the infra-red.

Irwin, John B. The expected performance of the EDVAC on some astronomical problems. See *Pub. A.S.P.*

Kiess, C. C. New infra-red band of ZrO and TiO. See *Pub. A.S.P.*

Kopal, Zdeněk and Martha B. Shapley. Catalogue of orbits of eclipsing binary systems.

Kron, Gerald E. Practical use of photocells at maximum performance. See *Pub. A.S.P.*

McKellar, Andrew. Evidence for the existence of polyatomic molecules in the atmospheres of late N-type stars. See *Pub. A.S.P.*

Merrill, Paul W. A damped oscillation in the atmosphere of 48 Librae. See *Pub. A.S.P.*

Münch, G. The effect of electron scattering on the spectra of high temperature stars.

Page, Thornton. The spectrum of Comet Bester. See *Pub. A.S.P.*

Popper, Daniel M. Spectra of long-period eclipsing binaries. See *Pub. A.S.P.*

Reber, Grote. Galactic radio waves.

Sanford, R. F. The velocity variation of Boss 1074. See *Pub. A.S.P.*

Slipher, V. M. Some inferences from the obscuration of spiral nebulae.

Whitney, Balfour S. A photo-red study of the eclipsing variable QY Aquilae. See *Pub. A.S.P.*

Wilson, O. C. The nuclear and nebular spectra of the planetary nebula NGC 2392. See *Pub. A.S.P.*

Wrubel, Marshal H. The exact curves of growth for the formation of absorption lines according to the Milne-Eddington model.

Wulf, Oliver R. and Seth B. Nicholson. Recurrent geomagnetic activity and lunar declination. See *Pub. A.S.P.*

Zernike, F. Degree of coherence and optical image formation.