tion field. Under the assumptions that (1) intergalactic space is an *HI* region, i.e. no radiation of wave length less than .912A escapes from galaxies, (2) the quality of the radiation is like that found by Dunham for the solar neighborhood, (3) the gas kinetic temperature is 50°K, it is found that the *CaII* would exist in a detectable amount for a total density of 5×10^{-28} g/cm³. Failure to notice absorption on existing spectrograms rules out a density much over 10^{-27} g/cm³, since absorption goes as the square of the total density. The test for *NaI* is about ten times less sensitive.

An expanding intergalactic continuum of density 5×10^{-28} g/cm³ could not be detected as an emitter of the 21 cm hydrogen line, because the red shift would make the portion seen by the receiver band width an optically thin layer. If intergalactic gas in the non-expanding local group of galaxies has a turbulent velocity no greater than the peculiar velocities of the galaxies, about 50 km/sec, then detection of the above mentioned density at a temperature of 50°K should be possible. M 31 could possibly be used as a hot background source for detection of the 21 cm line in absorption.

It may be concluded that detection of an intergalactic density of the order of magnitude predicted by Hoyle's theory of continuous creation is not hopeless, and that a careful observational test seems warranted.

1. A. E. Whitford, *A. J.* 58, 49, 1953.
2. *M. N.* 106, 159, 1946.
3. *Physics Today* 6, 7, 1953.

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An eyepiece interferometer for double star measurement.

The desirability and feasibility of an eyepiece interferometer was called to our attention early in 1951 by a private communication from W. S. Finsen of Union Observatory, Johannesburg, and later by his publication.¹ The Anderson-type interferometer, in use by Wilson at Flower Observatory since 1934, would not be readily adaptable for testing and use on other telescopes. On the other hand, an eyepiece interferometer made to fit in a standard eyepiece tube could, with relatively minor adjustments and calibrations, be used on any telescope having a focal ratio between limits for which the interferometer was designed.

Following the general plan suggested by Finsen, light from the objective enters the present interferometer through a collimating lens 16 mm diameter, 38 mm focal length, focussed in the telescope so as to produce parallel rays from a star. The slits for dividing the beam, cut out of thin brass shim stock, are located at the Ramsden disc (image of the objective) of the collimator. The outer boundary of the slits is a circle having a diameter of 1.9 mm, which would, therefore, be entirely within the Ramsden disc for any objective with focal ratio shorter than $f/20$, provided all centers are coaxial.

The slit mechanism was designed by Dr. Moore, who did the machine work involved on all parts of the interferometer. It consists of 3 plates of thin brass shim stock, in one of which is a fixed punch hole, centered on the optical axis, which always forms the outer boundary of the slits. The inner boundaries are formed by edges of the other two plates, mounted in contact with the first, and each attached separately to two opposite screw nuts which are both engaged to the same screw bolt having opposite threads on each end. Readings of the screw head can thus be calibrated to give the variable separations of the slits, whose inner boundary may be straight or circular, depending on which edge of the movable sheets marks it.

Slits so situated are optically equivalent to similar slits having the full diameter of the objective and located near its plane. They can be freely rotated for proper orientation on a double star, and their position angle is indicated by a vernier pointer on a 3-inch aluminum circle.

After passing the slits, the light from a star is next received by a miniature telescope, through the eyepiece of which the interference pattern may be viewed. Except that its objective must enclose the light cone from the slits, there are no requirements on its construction aside from convenience of size, optical feasibility and sufficient magnification to show clearly the interference fringes. The present instrument has an objective 21 mm in diameter, and slightly over 2 inches focal length. The eye end is a tube capable of delicate focussing adjustment, which holds snugly a standard 1¼-inch tube commercial eyepiece of about ½-inch effective focal length. All optical surfaces of the eyepiece interferometer are coated. The total length of the instrument is about 6 inches.

Tests on several telescopes over ten inches in diameter, including both refractors and reflectors,

have shown clear interference fringe patterns suitable for measurement of double stars. For precise work with any telescope it would be necessary only to calibrate the orientation on a wide fixed double, with slits very narrow so as to elongate and line up the diffraction images. Linear and hence angular scale can be determined from measuring-screw determinations of the slit dimensions combined with the focal lengths of the objective and collimator, which result directly from a measured diameter of the Ramsden disc.

Approximate test measures of close doubles with the 18-inch Flower refractor during this past summer have indicated the feasibility of such development of the instrument to its expected precision.

I. M. N. III, 387, 1951.

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TITLES OF ADDITIONAL PAPERS PRESENTED AT THE MEETING IN NASHVILLE, TENN.

- Bondi, Herman. The Stebbins-Whitford effect. (Symposium paper Number 4.)
 Blanco, Victor M. Photoelectric colors of M stars.
 Cook, Allan F., II. Interpretation of a photometric analysis of a Perseid spectrogram.
 Cox, Arthur N. Photometry in the southern galactic cluster NGC 2516.
 Deutsch, Armin J. The electromagnetic field of an idealized star in rigid rotation.
 Dodson, H. W., L. Goldberg and E. A. Muller. The broadening of $H\alpha$ in solar flares.
 Jacchi, L. G., F. L. Whipple and F. W. Wright. Photographic study of the δ Aquarid meteors.
 Lindsay, E. M. Emission objects in the Small Magellanic Cloud.
 MacRae, Donald A. and Jurgen Stock. Spectrophotometry of planetary nebulae.
 Menzel, Donald H. A magneto-hydrodynamic theory of the origin of the solar system.
 Smith, Harlan J. The pseudo cluster-type variables UZ Leonis and FG Hydrae.
 Stock, Jurgen. Photoelectric spectrophotometry of B and A stars.
 Warwick, Constance S. Some characteristics of solar flares.
 Warwick, James W. The equations of transfer for line formation.

THE ECLIPSING SYSTEM ZZ BOOTIS

By SERGEI GAPOSCHKIN

Abstract. A light curve has been derived from 1554 photographic observations obtained at the Harvard College Observatory. Use has been made of the radial velocities of Dr. Shajn, and the absolute dimensions of this rather unusual system, which consists of two almost equal components, have been computed.

Observations and the period. Some 1800 photographic plates of the Harvard collection are available for the region of the star ZZ Bootis. I have obtained 1554 estimates, principally on plates of the AC series. The results from other plates did not differ systematically.

In Table I are given 48 individual observations of minima of ZZ Bootis which served for a re-determination of the period. The first column of Table I gives the Julian Day, corrected to the sun; the second column contains phases of the minima computed with the original period, 4.958 days; and the last column gives phases computed with the new period. This period represents quite satisfactorily two minima not consistent with the original period. The reason for this lies in the fact that the original period had a short base line and was therefore already uncertain in the second decimal place. The revised elements for primary minimum are

$$\text{JD Min } \odot = \text{JD } 2430868^d.650 + 4^d.991749 \text{ E.}$$

Light curve. Means were taken over equal intervals of phase except within the two minima. Table II represents my photographic light curve

TABLE I. THE OBSERVED INDIVIDUAL MINIMA OF ZZ BOOTIS

JD 2400000 +	Phase (orig.)	Phase (new)	JD 2400000 +	Phase (orig.)	Phase (new)
15815.904	0.977	0.409	25347.682	0.481	0.916
16127.889	.902	.909	25352.691	.491	.919
16202.806	.012	.918	25357.686	.499	.920
16454.941	.867	.428	25704.663	.488	.430
16544.806	.992	.431	26717.933	.853	.419
16896.728	.973	.931	26732.945	.881	.427
17617.938	.436	.412	26752.839	.893	.412
17994.843	.456	.917	26752.898	.905	.424
18261.926	.325	.422	26892.632	.089	.417
18281.929	.360	.430	26932.582	.146	.420
18366.758	.469	.423	27209.616	.023	.918
18461.616	.601	.426	27234.601	.062	.924
19836.780	.964	.914	27239.611	.072	.927
19836.825	.973	.923	28549.943	.359	.427
19946.624	.119	.919	28579.816	.384	.411
21728.717	.557	.927	28669.698	.513	.417
22030.743	.474	.432	28669.734	.520	.425
23113.875	.935	.416	30381.929	.860	.430
23445.883	.899	.927	30406.890	.894	.430
23500.805	.977	.930	30441.801	.936	.424
25247.921	.360	.931	30868.621	.023	.929
25272.880	.394	.931	30868.650	.029	.935
25297.855	.431	.934	30878.571	.030	.922
25307.789	.435	.924	30878.606	.037	.929

on the basis of 1554 observations. The light curve (see figure) exhibits two well-defined minima of relatively short duration; it shows no