ference between the sexes (the protoplasmic mass being the same as far as can be observed) it is the female, not the male, that has the larger quantity of nuclear material. This fact has recently been demonstrated by the reviewer in a dozen different species of hemiptera, representing eight genera, and the structure of the spermatozoa shows that the same is undoubtedly true of many other species. The difference is here one of nuclear constitution and is irrespective of temporary changes of nuclear volume such as are common to all cells. But even here we can not regard the quantitative difference of the nuclei as being primarily responsible for the sexual differentiation, for in some of the species of the same group no perceptible difference in this respect exists between the sexes.

Without questioning the interest and value of Professor Hertwig's experimental results, it, therefore, seems to us that his theory of sex-production is without real foundation, and that, in the specific form that he has given it, it is untenable. E. B. WILSON.

ASTRONOMICAL NOTES.

THE FIGURE OF THE SUN.

Two articles by Professor Charles Lane Poor have recently appeared in *The Astrophysical Journal* dealing with a variation in the figure of the sun. This research comes with special interest at the present time, when so many writers are trying to trace relationships between various terrestrial phenomena and different forms of solar activity.

Among the remarkable photographic work done by Rutherfurd was a series of photographs of the sun. These are still of such unimpaired excellence that they permit admirable determinations of the sun's diameter. From a series of such plates extending over the years 1870–1872, measurements were made of the polar and equatorial radii, from a discussion of which it appears that the polar radius is sometimes greater and sometimes less than the equatorial radius. The individual determinations of this difference (polar radius —equatorial radius) vary between $+0.77''$ and $-0.72''$, and the means are as follows: for 1870, September 22, $+0.50'' \pm 0.10''$, for 1871, July 19, $-0.32'' \pm 0.16''$, and for 1872, July 2, $+0.22'' \pm 0.09''$. There is thus indicated a change in the relative values of the polar and equatorial diameters of the sun. This conclusion, if true, is of great importance, and it is not strange that Professor Poor desired to verify his results by reference to other and independent determinations of the form of the sun.

A large number of heliometer measurements of the diameter of the sun were available from a very thorough discussion, by Dr. Auwers, of the transits of Venus, in 1874 and 1882. Dr. Auwers reached the conclusion that the diameter of the sun at distance unity is 1,919.26″, and that the polar diameter slightly exceeds the equatorial diameter. This difference, however, was attributed by him to the personal equation on the part of the observers between measures of vertical and horizontal diameters. The observations as discussed by Auwers gave no indication of a variation in the relative values of the different diameters, but were rearranged in a form suitable for this discussion by Professor Poor.

Measurements were also made of a short series of photographs of the sun taken at Northfield by Dr. Wilson. Both the heliometer determinations and the Northfield photographs seem to confirm the results obtained from the Rutherfurd photographs. Professor Poor thus sums up his conclusions:

> The present investigation would seem to show, therefore, that the ratio between the polar and equatorial radii of the sun is variable, and that the period of this variability is the same as the sun-spot period. The sun appears to be a vibrating body whose equatorial diameter, on the average, slightly exceeds the polar diameter. At times, however, the polar diameter becomes equal to and even greater than the equatorial—the sun thus passing from an oblate to a prolate spheroid.

In a second paper Professor Poor extended his investigations to include the elaborate heliometer determinations of the sun's dimensions, carried on at Göttingen by Shur and Ambronn. These observations covered a full sun-spot period, from 1890–1902. Ambronn, who discussed the observations, gave his special attention to the mean diameter of the sun, so that again it became necessary to

rediscuss the results. This Professor Poor has done. His conclusion is that these observations, when properly interpreted, also confirm his theory of the variable form of the sun, and curves are given which confirm his views.

It should be stated, however, that the differences derived from the Göttingen observations are extremely small, and that Ambronn was of the opinion that the differences between his determinations of the polar and equatorial diameters were due to accidental errors.

RELATION BETWEEN THE MOTION IN THE LINE OF SIGHT, AND THE VARIATION IN BRIGHTNESS OF VARIABLE STARS.

The discovery of new variable stars has gone on with increasing rapidity in recent years, until now about three thousand variables are known. The majority of these have been found by photographic means at the Harvard Observatory. Fair progress has been made also in the study of the light-curves of these stars, and definitive elements have been found for several hundred of them. It can not be said, however, that great progress has been made in the determination of the underlying causes which produce the variations. In the case of the Algol stars it is sure, both from theoretical considerations, and from spectroscopic determinations of their motion, that the variation is caused by a relatively dark, eclipsing body. The brilliant lines of incandescent hydrogen, which appear near maximum in the spectra of many stars of long period indicate with considerable certainty that the variations in their light are associated with eruptive disturbances of some sort. It was long ago pointed out that our sun is probably a variable star of long period and small range, and many variable stars may exist, whose changes are caused by spots of greater or less size. Nevertheless, it still remains true that for the great majority of variable stars no sure key has been found to the secret of their changes.

Two recent bulletins of the Lick Observatory (Nos. 62 and 83) have dealt with a new and extremely important phase of this question. In these, Dr. Ralph H. Curtiss, of that observatory, shows that for the well-known variable star W Sagittarii there is a most intimate relation between the velocity of motion in the line of sight and the changes in brightness. This was well indicated by a comparison of the Lick determinations of motion with the early observations of the light-curve by Schmidt. The similarity is most strikingly shown, however, when the velocity-curve is compared directly with the light-curve derived from recent photometric measurements by Professor Pickering, given in the Harvard Annals, Vol. 46, Part 2. A comparison of these curves shows a close resemblance even in the details, and proves conclusively that both phenomena are due to the same underlying causes. Incidentally a striking proof is furnished of the accuracy of the two widely separated investigations thus critically compared. Dr. Curtiss's work marks a distinct step in advance in the study of variable stars, and it is to be hoped that the research may be extended to as many and as faint variables as possible.

S. I. BAILEY.

CURRENT NOTES ON METEOROLOGY.

BRIEF COMMENT ON RECENT ARTICLES.

IN the recent numbers of the *Meteorologische Zeitschrift* (Nos. 7–10, Vol. XXII., 1905) there have been many contributions of general scientific interest, on which the following brief comments are made:

The exploration of the free air at great heights has been giving records of very low temperatures. On March 2, last, at a height of 9,717 meters, the temperature was — 85.4° C., and on April 4, at 11,010 meters, it was — 79.6° C. These records were obtained by means of *ballons-sondes* sent up from Vienna. So rapid has been the accumulation of data from the free air that the mean annual temperature and the vertical temperature gradients at each interval of one kilometer up to a height of eleven kilometers have been determined, using the results obtained on nearly 600 balloon ascents.

ANTARCTIC meteorology is making rapid progress. On the Swedish expedition, under