NOTES

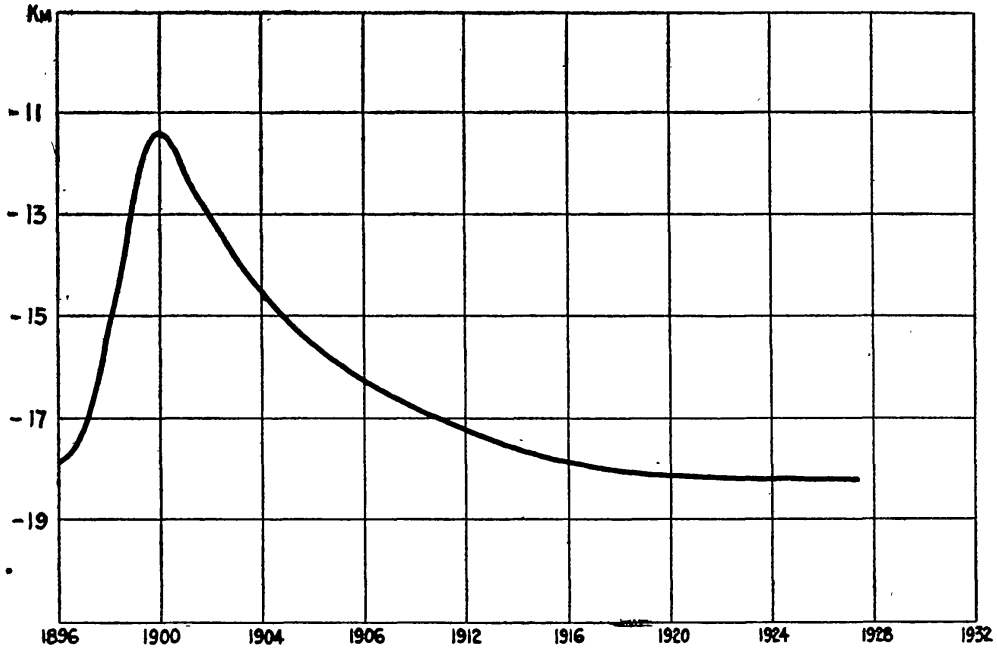
No. 2972. A revival of No. 2965.
No. 2976. A return of No. 2945.
No. 2983. A return of No. 2956.
No. 2987. A bipolar group with irregular polarities on May 16, 17, 18 and 19. On May 21 and 22 the preceding S spots had disappeared, but on May 23 and 24 a single S spot was observed, the N spots having disappeared.
No. 2991. A very small α spot with S polarity just south of the equator.
No. 3001. A return of No. 2961.
No. 3005. Two small S spots preceded by a weak N field with no spot visible.
No. 3007. A return of No. 2978.
No. 3010. A return or revival of No. 2979.
No. 3013. A small α spot with N polarity in the northern hemisphere.
No. 3019. A return of No. 2989.
No. 3021. On June 12 this group consisted of two small spots with N polarities. No spots were seen in this region on June 13 and 14, but on June 15 a small bipolar group with regular polarities appeared.
No. 3025. A return or revival of No. 3002.
No. 3041. A bipolar group with irregular polarities.
No. 3042. A return of No. 3007, which was a return of No. 2978.

NOTE ON THE LONG PERIOD SYSTEM OF POLARIS

In 1899 Dr. Campbell, from observations secured with the Mills Spectrograph, found that the radial velocity of *Polaris* is variable with an amplitude of about 6 km/sec. in a period of 3.968 days. A comparison of the observations secured in 1896 with the velocity curve of 1899 showed that the center of mass velocity is variable. Determinations of the velocity curves for subsequent years have amply confirmed this conclusion and have shown that the period of variation is long. So many inquiries have recently been made concerning the data in our possession relating to this long period system that a brief statement regarding the present status of these results may be of interest.

A series of three prism spectrograms covering the four-day period of velocity variation has been secured each year since 1899 at the Lick Observatory, from which the center of mass velocities corresponding to the different epochs have been de-

rived. The results obtained up to the present year are represented by the preliminary curve shown in Figure 1. It will be seen that the components of the binary system have not completed a whole revolution so that the period must be greater than thirty years. The minimum radial velocity of approach as read from the curve is about -11.4 km/sec. and the maximum



LONG PERIOD RADIAL VELOCITY CURVE OF *POLARIS*

FIGURE 1

velocity towards us is approximately -18.2 km/sec. so that the amplitude of the long period variation is only slightly greater than that for the four-day period. It is also evident that the eccentricity of the orbit is high and will probably prove to be of the order of 0.6. Until the portion of the curve representing the observations of 1896-1900 has been repeated, nothing further can be said concerning the orbital elements of this long period binary system.

It is well known that *Polaris* is a Cepheid variable, the light period being identical with the short period variation in radial velocity, and it appears probable that here as in other Cepheids we are dealing with the pulsations of a single giant star, and not with the orbital motion of the component of a binary system.

The long period variation in velocity, on the other hand, appears to be very definite evidence that *Polaris* is a binary system, the two components of which (one a Cepheid variable) revolve about their common center of gravity in a period of more than thirty years.

J. H. MOORE.

NOTE ON THE LONGITUDE OF THE LICK OBSERVATORY

Advantage was taken of the Radio Time Signals for the World Longitude Determination to effect a re-determination of the longitude of the Lick Observatory.

The instrument used for time determinations was the Repsold Meridian Circle, fitted with a self registering micrometer, hand driven. Observations were secured on eleven nights, on seven of which the instrument was reversed. Twenty-six determinations of the collimation were made, both with the collimators and at the nadir. The level was determined by nadir observations, as usual, and the azimuth from circumpolar stars. The separate determinations of clock correction were plotted on a large scale and the curve was drawn which seemed best to represent the going of the clock. With the exception of a discontinuity of five hundredths of a second at the epoch of an earthquake, the curve is nearly straight, indicating a fairly constant rate. The Riefler clock was used, running under conditions of constant pressure, but not constant temperature.

There is decided evidence that our time determinations are affected by a reversing error, such as has been found elsewhere. Observations made with the telescope in the position clamp West indicate the clock to be five hundredths of a second faster, on the average, than similar observations made in the position clamp East. Pending a more complete investigation of the effect, the best that could be done was to take the average of the results in the two positions.

The radio signals emitted from Washington, through Annapolis and Bellevue, and from Honolulu were observed. Saigon and Bordeaux were heard, but no attempt was made to use these transmissions. The signals were recorded on the chrono-