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NOTES

THE RADIAL VELOCITY OF RU CAM DURING ITS RECENT QUIESCENT PHASE

The remarkable, sudden cessation of the light variation of the 22-day variable RU Cam (Demers and Fernie 1966) permits the investigation of certain aspects of stellar pulsation that are usually difficult of access in more conventional pulsating stars. In particular, it is possible to establish quite accurately the radial velocity of the center of mass of the system for comparison with the velocity curve derived during the epochs of pulsation. The importance of such a comparison lies in the usual procedure of integrating the velocity curve to derive the change in stellar radius. An assumption is always required as to the velocity of the center of mass. When the mean velocity during pulsation is equal to the center of mass velocity, we can say that no net inward or outward motion is observed. If the mean velocity is more negative, we are observing mass loss from the stars, and if the velocity is positive, we are observing material that is predominantly falling in.

During January, 1965, five coudé spectrograms of RU Cam were obtained with the 120-inch coudé spectrograph at the Lick Observatory. With the kind co-operation of the Lick Staff, 10 nights within one coudé run were assigned to this project in order to cover one cycle from minimum to a little past maximum light. At that time it was not realized that the star had virtually ceased varying. Due to poor weather only three spectrograms suitable for radial velocity measurement were secured. One further spectrogram was secured in October, 1966, with the 36-inch camera of the 200-inch Hale Telescope.

Because of the presence of numerous rotational lines of the $A^2\pi$–$X^2\Sigma$ transition of the CN molecule, great care was taken to identify unblended atomic lines. Seventy apparently sharp lines of moderate strength were measured in the interval between λ6717 and λ5800 Å. After identifications of the atomic lines, all but twenty were discarded because of blending, largely with CN. The twenty lines used for velocity measurement are listed in Table 1.

In Table 2 we list the measured velocities, the data of observation and the phase as computed from the recent, large-amplitude maximum observed by Michalowska-Smak and Smak (1965) at J.D. 2437675.9 and a period of 22.134 days. Two spectrograms of γ Tau (type K0 III) were taken at the Lick Observatory using the same observational arrangement as was used for RU Cam. A night of utterly abominable seeing was chosen so that the exposure time would be sufficiently long to trail the star many times along the slit and avoid possible effects of short-term guiding errors on the illumination of the slit and hence the velocity. The velocities were obtained from the measurements of lines in Table 1. The velocities were +37.8 and +36.8 km/sec yielding a mean of +37.3 which may be compared with a velocity of +38.5 from the catalogue of R. E. Wilson (1950). Of the twenty-four plates used for the mean in Wilson's catalogue four are Mount Wilson plates; they too yielded a mean velocity of +38.5 km/sec. The difference between the Mount Wilson velocities and ours for γ Tau indicates that possibly our velocities should be corrected by +1.2 km/sec before making a comparison with Sanford's (1928) velocity curve, since Sanford's plates were probably taken with similar instruments as were the Mount Wilson velocities of γ Tau. It is obvious that our material is not sufficient to establish that a correction to the velocities of the Lick plates is required by the data, so we have left them unaltered for the discussion.

TABLE 1

LINES MEASURED FOR RADIAL VELOCITY

Wavelength	Identification	Wavelength	Identification
6643 64	Ni I	6162 17	Ca I
6592 92	Fe I	6141 72	Ba II
6562 82	H I	6137 69	Fe I
6496 90	Ba II	6122 22	Ca I
6493 78	Ca I	6065 49	Fe I
6439 07	Ca I	5895 92	Na I
6411 66	Fe I	5892 88	Ni I
6436 84	Fe I	5889 95	Na I
6335 34	Fe I	5857 45	Ca I
6163 56.	Fe I	5853 68 .	Ba II

TABLE 2

RADIAL VELOCITY MEASUREMENTS OF RU CAM

Date JD 243+	Dispersion (Å/mm)	Velocity (km/sec)	Phase from Max (days)
8770 89	16 0	−24 3±0 7	10 42
8773 94	16 0	−25 5±0 5	13 47
8774 92	16 0	−25 5±0 4	14 45
9147 75	40 0	−22 0±3.0	11 00
9161 60	40 0	−18 6±1 9	2 67
9166 67	40 0	−21 3±3 0	7 74
9180 65	40 0	−23 7±2 7	21 72
9183 56	40 0	−22 8±2 0	3 49
9424 97	13 5	−22 1±1 0	0 47

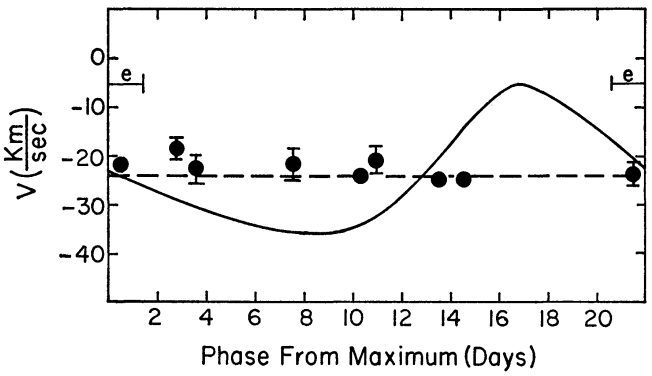

FIG. 1.—Recent radial velocities of RU Cam plotted against phase Probable errors that are large enough to show are indicated. Sanford's velocity curve, mean velocity, and phase in which hydrogen emission was observed by Sanford are shown.

Five spectrograms at 40 Å/mm in the blue region were obtained at the David Dunlap Observatory. They were measured both on a Grant oscilloscope measuring engine and a Zeiss comparator. The mean difference between two measurements of the same plate is 1.7 km/sec. Measurement by the same methods of two plates of the R0 stars HD 156074 and HD 182040 yielded corrections of −5.6 and −4.0 km/sec for a mean of −4.8, to reduce them to the Mt. Wilson values of Wilson (1953). Although two plates do not yield definitive corrections, it seemed best to include the correction before entering the velocities in Table 2, since a correction is to be expected when measuring such a complex spectrum at moderate dispersion.

The velocity measures in Table 2 are plotted against phase in Figure 1. Also shown is Sanford's velocity curve, mean velocity, and phase of hydrogen emission. No emission was detected on any of our plates even though several were taken when emission would be expected. It is evident that the cessation of active pulsation discovered by Demers and Fernie (1966) is confirmed so far as velocity variations are concerned. It also appears that the current quiescent velocity lies within 1–2 km/sec of the mean velocity found by Sanford. Caution must be advised in the application of this conclusion to Cepheids of similar period. Sanford (1928) pointed out that the phases of velocity and light variation yielded changes in radius that are quite different from those found for Cepheid variables. In addition, the spectral type varied within the range of types K–R, and is currently about type R0, which is unheard of for classical or type II Cepheids.

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