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Resumption of Pulsation of RU Cam around 1970: Evidence from the VSOLJ Database

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1. Introduction

RU Cam has been claimed to have stopped pulsation. I found from the VSOLJ Database that RU Cam again showed appreciable variation around 1970. According to Burnham's Celestial Handbook (Burnham, 1978), variation no greater than 0.04 mag was detected in 1966, and RU Cam was considered to be a Cepheid which stopped pulsation.

However, T. Kato expressed: "Though RU Cam is called as a variable star which stopped variation, recently released Hipparcos Catalogue shows the Hipparcos Satellite detected appreciable variation. Though the star may have dropped from most amatuer's target lists, the star should receive more attention. The Hipparcos Satellite detected variation up to 0.2 mag. If the amplitude is growing, we may have a chance to see more variation now".

I searched through the VSOLJ Database whether there is any evidence of resumption of the pulsation in this variable. The result shows the period of cessation of the pulsation as already claimed, but the data also clearly shows the star resumed variation again around 1970. I describe the data in two parts.

2. The Period 1907–1911

In this period, the star varied between 8.0 – 9.6 mag, corresponding to an amplitude of 1.6 mag. From the inspection of the light curve, I obtained the period of ∼20 d, which agrees with the 22-d period listed in GCVS. The largest observed variation was detected between 1997 April 11 (9.69 mag) and 1997 April 20 (8.02 mag), corresponding to an amplitude of 1.67 mag. Between 1907 and 1908, the star showed variation with a range of 8.2 – 9.2 mag, and a period of ∼20 d.

3. The Period 1964–1978

In the first half of this period, the star showed a range of 8.2 – 9.0 mag, corresponding to an amplitude of 0.8 mag. In 1968 and 1969, the range of variation became 0.6 mag, fluctuating around a mean level of 8.6 mag, without clear periodicity. It seems the star was stopping pulsation around this period.

However, in 1970 and 1971, I found an evidence of large variation of 0.8 mag (8.3 – 9.1), implying the variation, which once seemed to have stopped, resumed around this epoch. From the portion of the light curve showing clear periodicity, I yielded a period of 21.5 d.

In 1973 and 1974, the variation with an amplitude of 0.5 mag (8.4 – 8.9) was also observed, having a period of ∼20 d. I cite some observations in Table 1. The observer is M. Sono. From these data, it may be inferred that RU Cam resumed pulsation with an amplitude of 0.5 mag, and a period of ∼20 d.

Table 1. Selected observations of RU Cam

year	month	day	mag.
1974	11	5	8.9
1974	11	14	8.4
1974	11	25	8.9

Since 1976, the amplitude again decreased to 0.4 mag, and the periodicity became less clear than around 1975. The data were sparse since 1986, but they also seem to imply the amplitude decreased, and the periodicity became unclear.

Acknowledgments. This work has been based on the VSOLJ Database. The used data were made by the following 12 observers: M. Iida, N. Ichinohe, T. Ishihara, N. Iwakami, M. Koshiro, T. Miyake, M.Morita, E. Mochizuki, K. Kozawa, T. Saito, M. Sekiguchi, M. Sono.

References

Burnham R. Jr. 1978, Burnham's Celestial Handbook vol.I, p.327-328, Dover, USA.

Reanalysis of Ichinohe's Observations of RU Cam

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The W Vir-type variable star, RU Cam, once claimed to have stopped pulsation (Demers, Fernie 1966; Huth 1966), has been known to show irregularly variable amplitude (Kollath, Szeidl 1993). Sato et al. (1997) has also shown from the analysis of the VSOLJ archive that visual observers of the VSOLJ have recorded the cessation of pulsation and its possible resumption, together with the phase of large-amplitude variation around 1910. The observations around 1910 were done by Ichinohe, a part of which was published by the observer himself (Ichinohe 1909). We present the result of reanalysis of Ichinohe's original data until 1911, by using the Hipparcos V-magnitudes of the comparison stars.

The original observational records using Pogson's step method were first analyzed by a least-squares program (Kato, in preparation) to obtain the best step values of the comparison stars and the variable star. The resultant step values of the comparison stars were used to calibrate the original observation into the Hipparcos V system. Table 1 summarizes the result of best determined step values of the comparison stars.

Table 1. Comparison stars

Desig.	BD	Steps	Hipparcos V	O-C*
a	+70°450	0.00	8.75	0.05
c	+70°447	1.33	9.05	0.10
d	+69°422	-3.40	8.04	-0.01
e	+69°420	1.44	8.90	-0.07
b	+70°448	2.29	9.06	-0.08
g	+70°445	5.29	9.85	0.14
f	+70°453	4.54	9.43	-0.14

* Residuals from eq. (1)

A least-squares fit of the step values to the Hipparcos V-magnitudes yielded the following conversion equation.

$$\mathsf{V} = 8.70 + 0.191 \cdot \mathsf{step} \tag{1}$$

By using this, we have reduced the original observations to the present Hipparcos V-scale. The result is tabulated in Table 2.

Table 2. Ichinohe's observations

JD-2410000	mag	JD-2410000	mag	JD-2410000	mag	JD-2410000	mag
7649.547	8.69	7706.709	8.19	8117.068	8.86	8445.040	8.65
7650.805	9.12	7708.680	8.22	8148.997	8.44	8446.042	8.56
7651.823	9.08	7713.830	8.04	8168.163	9.07	8450.061	8.94
7652.708	9.21	7723.681	9.43	8173.192	8.22	8450.961	9.35
7654.726	9.47	7724.642	9.14	8174.209	8.32	8526.285	8.47
7657.799	8.78	7728.690	8.42	8175.125	8.42	8538.253	8.35
7658.645	9.06	7735.672	8.36	8181.199	8.47	8558.232	8.55
7658.646	9.06	7740.667	9.09	8183.074	8.54	8664.018	7.80
7664.665	8.37	7741.774	9.08	8211.088	9.05	8714.062	8.56
7665.646	8.47	7742.732	9.40	8212.120	8.91	8738.181	8.96
7666.584	8.48	7743.796	9.13	8215.051	8.26	8920.202	8.74
7667.588	8.71	7746.817	8.90	8216.942	8.43	8951.024	8.97
7668.605	8.74	7747.822	8.74	8306.160	8.38	8971.126	8.06
7668.653	8.70	7749.846	8.25	8311.021	8.51	8982.881	8.93
7671.611	8.88	7759.819	8.37	8324.217	8.78	9028.997	9.43
7671.726	8.95	7762.650	9.30	8331.152	8.26	9053.913	8.99
7671.826	9.07	7763.797	9.18	8336.140	8.76	9061.997	8.41
7675.591	9.53	7881.059	8.64	8337.056	9.21	9062.985	8.41
7676.586	9.79	7889.149	8.43	8354.965	8.33	9072.997	9.24
7679.625	9.41	7890.073	8.24	8359.182	8.80	9088.180	8.31
7680.709	9.01	7904.153	8.64	8364.126	8.89	9090.235	8.54
7682.697	8.61	7945.240	9.07	8368.954	9.06	9103.001	8.51
7685.835	8.00	7949.206	8.48	8390.133	9.09	9122.115	8.99
7686.631	8.50	7950.060	8.44	8392.944	8.75	9128.115	7.99
7687.600	8.38	7950.988	8.44	8405.003	8.99	9147.110	8.56
7689.715	8.37	7957.108	8.32	8406.051	9.57	9150.087	7.80
7703.648	8.76	7962.941	8.95	8413.047	8.99	9160.098	8.75
7704.697	8.55	7966.037	9.18	8422.085	8.61	9183.034	8.92
7705.628	8.37	8057.105	9.12	8424.165	8.25		

During this reduction procedure, possible inconsistencies were found among Ichinohe's (1909) step reduction for JDs 2417949.206, 2417962.941, 2418390.133 and 2418413.047. We consistently used our new values in the following analysis.

After heliocentric corrections, the data were analyzed using the Phase Dispersion Minimization (PDM) method (Stellingwerf 1978) to obtain the pulsation period. The resultant theta diagram is shown in Figure 1. The best determined period of 22.18 d, which confirms the analysis by Ichinohe (1909), well agrees with the 22.187 d period given before 1917 (Huth 1966).

The averaged light curve constructed from these observations is shown in Figure 2. The epoch of the light maximum was rather arbitrarily taken as HJD 2419150.085. Each point represents an average of 0.1-phase bin, typically constituted of ~ 10 observations, and vertical bar 1-sigma error. The range of light variation was 8.26 (0.06) – 9.33 (0.08), giving an amplitude of 1.07 (0.10), which also confirmed the earlier reports. Our new analysis, however, rather disproves the existence of the secondary maximum which Ichinohe (1909) described, giving a more consistent, typical W Vir-type, light curve with those of other observers at that epoch.

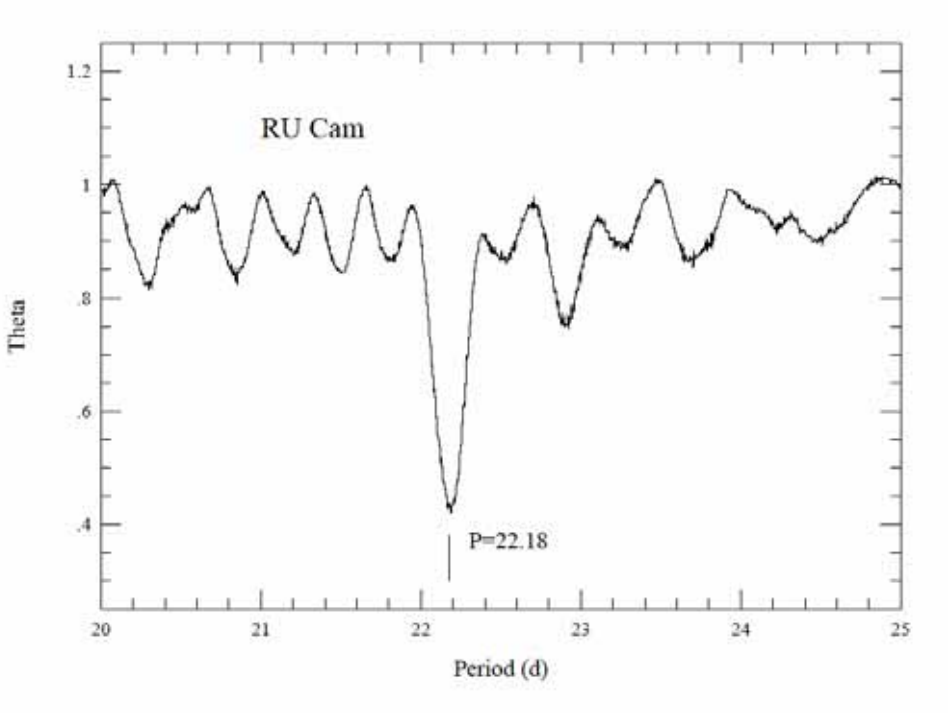

Figure 1. Period analysis of RU Cam

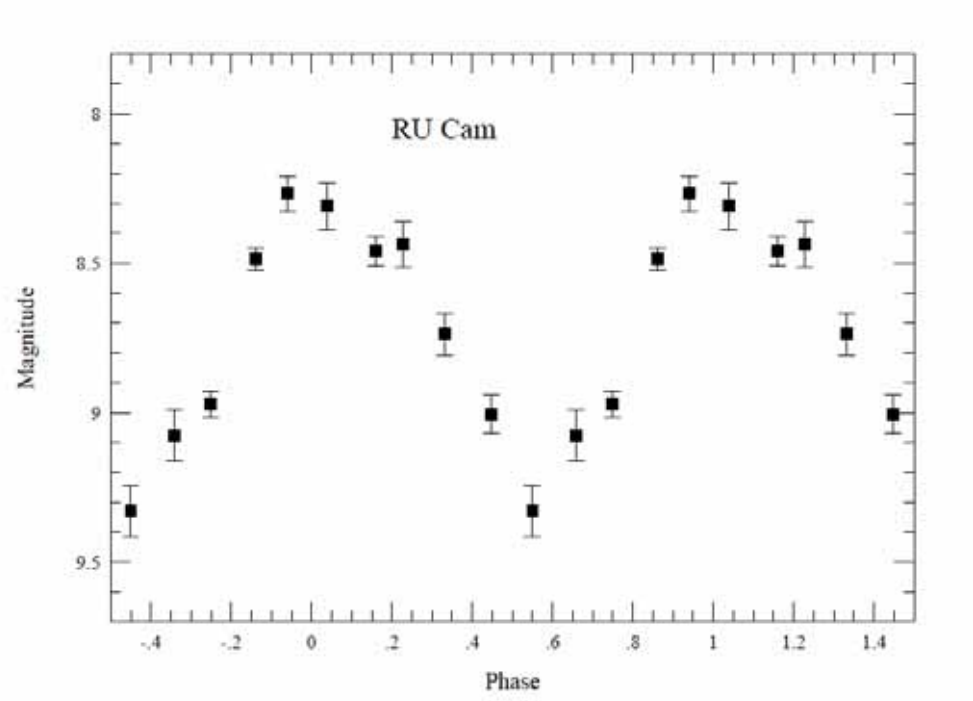

Figure 2. Average lightcurve of RU Cam

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References

Demers S., Fernie J. D. 1966, Astrophys. J. 144, 440
Huth H. 1966, Dir Sterne 42, 129
Ichinohe N. 1909, Astron. Nachricht. 180, 363
Kollath Z., Szeidl B. 1993, Astron. Astrophys. 277, 62
Sato, M., VSOLJ Variable Star Bull. 24, 1
Stellingwerf R. F. 1978, Astrophys. J. 224, 953

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