THE LONG-TERM MULTI-COLOUR VARIATION OF
# THREE BRIGHT RS CVn TYPE SYSTEMS

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Name of the object:	
HR 1099, σ Gem, λ And	

Observatory and telescope:	
Ege University Observatory, 48-cm Cassegrain telescope and 35-cm Schmidt-Cassegrain telescope	

Detector:	SSP-5 photomultiplier, high-speed three-channel photometer

Filter(s):	BVR, U (from 2000)

Date(s) of the observation(s):	
1996-2005	

Availability of the data:	
Available at the IBVS website (`5953-t1.txt` – `5953-t6.txt`)	

Type of variability:	RS CVn

Table 1. The information log of the observations. The first three columns list the target, comparison and check stars, while the last four columns in Table show the averages of yearly errors for observations in each filter.

Variable stars	Comparison stars	Check stars	err_U (mag)	err_B (mag)	err_V (mag)	err_R (mag)
HR 1099	10 Tau	11 Tau	0.019	0.017	0.013	0.014
λ And	ψ And	κ And	0.018	0.015	0.012	0.012
σ Gem	HD 60318	HD 60522	0.020	0.018	0.013	0.012
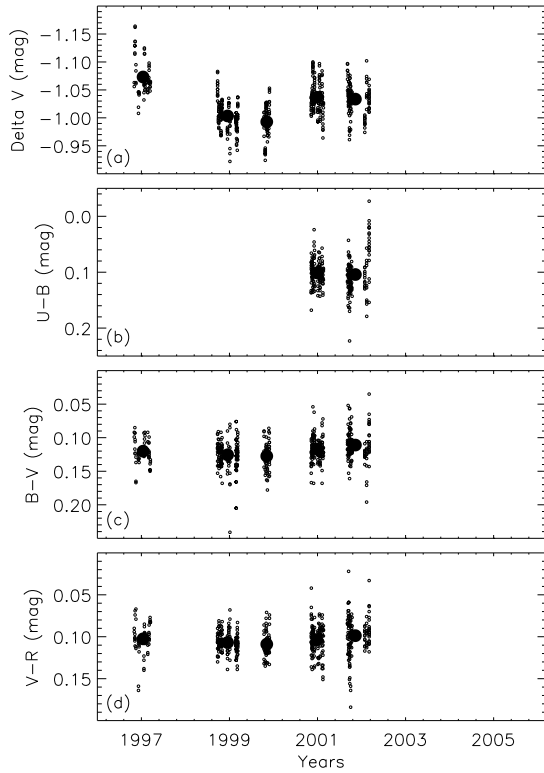
Figure 1. (a) The V brightness variation and (b) the $(U-B)$, (c) $(B-V)$, (d) $(V-R)$ colour variations of the σ Gem between the years 1996 and 2005. The larger filled circles denote the seasonal averages of observations.
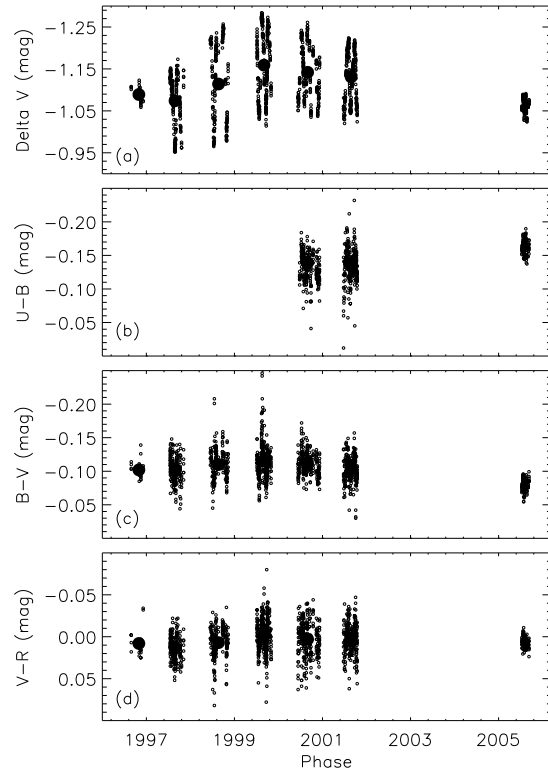
Figure 2. Definitions of the panels in the figure are the same as in Figure 1, but it is for λ And.
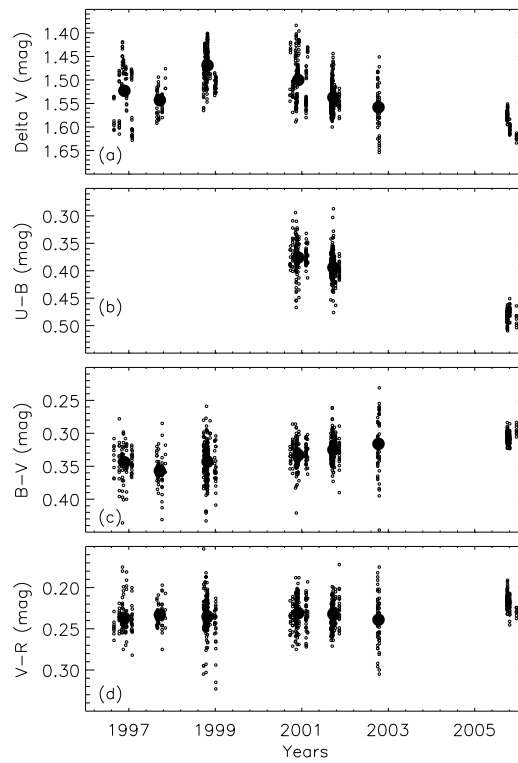
Figure 3. Definitions of the panels in the figure are the same as in Figure 1, but it is for HR 1099.

Remarks:

The short- and long-term light and colour variation of active stars is a very important subject, because they yield valuable information about their evolution in time and the distribution of different temperature structures on the stellar surface. Observations spanning for decades help to find the activity cycles. Since stars with longer periods have generally longer cycles, we think all data are important. Our stars is also difficult to observe because of their brightness, like λ And.

σ *Gem.* The results of our observations show no evident correlation between the long-term V light and colour variations for σ Gem (see Figure 1).

λ *And.* For this star also, no color index variations is seen which exceeds the limit (see Figure 2 and the error values in Table 1).

HR 1099 = V711 Tau. HR 1099 was observed with its visual component, which is a K3 V single star located 6 arcseconds away in the sky. Our observations show that when V brightness of the system decreases, than the $U - B$ colour index becomes redder, in accordance with the observations of Messina obtained between 1997-2005 (2008, Fig. 3. upper panel) which shows continuous decrease (reddening) during this time interval. In the same time our $B - V$ colour indices show marginal or no variations, while that of Messina's values are also constant except the last two years when the star seem to be slightly bluer. Our data in 2005 show a slight reddening, but this change is within 3σ of the measurements. The $V - R$ colour does not show a clear variation.

Reference:

Messina, S., 2008, *A&A*, **480**, 495