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UBV Monitoring of Eps Aurigae (I)*

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Abstract

UBV photometric monitoring of Eps Aurigae has been made at Yonsei University Observatory since the 1982-1984 eclipse. Among observations made in four seasons (1984-5, 1985-6, 1986-7, 1987-8) after the 1982-84 eclipse ended the observations of the latest season are presented. Standardized *UBV* light curves of Eps Aur exhibit a light variation in a semi-regular fashion with the amplitudes of 0.12, 0.19, and 0.29 for *V, B,* and *U,* respectively. Durations of this light variation may show a color dependency with the mean value of about 78 days whose minimum light on near JD2447118.

I. Introduction

A well known eclipsing binary Eps Aurigae(HR 1605, HD31964) for its long orbital period, P = 9885 days = 27.1 yrs, and for its unclarified companion has long been one of prime targets to many observers and theoreticians as well in the present century. World-wide observing net works were in action three times in the past, 1928-30, 1955-57, and 1982-84, in order to secure a better phase coverage of the eclipse. The latest eclipse was particularly benefitted by techniques covering the wide range of wavelengths from far ultraviolet to infrared.

Workshop on the Recent Eclipse of Epsilon Aurigae in 1985 was convened in Tuscon, Arizona, in conjunction with the 165th meeting of the American Astronomical Society, and the results presented with the intensive historical review by F. B. Wood are collected by Stencel (1985).

II. Observations and Light Variations

Uninterupted *UBV* photometric monitoring for the 27.1 year period eclipsing binary Eps

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Aurigae since the 1982-84 eclipse has been carried out at the Yonsei University Observatory with a 40-cm reflector at the Campus Station and a 61-cm reflector at the Ilsan Station. About 120 observations each in *UBV* passbands were made in every observing season. A detail explanation on the equipments used and the observation and reduction techniques employed are given elsewhere(Nha *et al.* 1986).

Among observations made during last four years since the 1982-84 eclipse after the recent eclipse ended, only the *UBV* light curves made in the last season, September 1987 ~ April 1988, are presented here to discuss the light variations outside eclipse. A total of 366 standardized *UBV* observations is made at the Ilsan Sation alone, and these are plotted in Figure 1. In this figure additional 156 observations made at the Campus Station in the same season are not included, because the data reduced are prevented by city lights and air pollutions and because the number of observations at Ilsan Station alone is large enough for the investigation of light variations outside eclipse of Eps Aur.

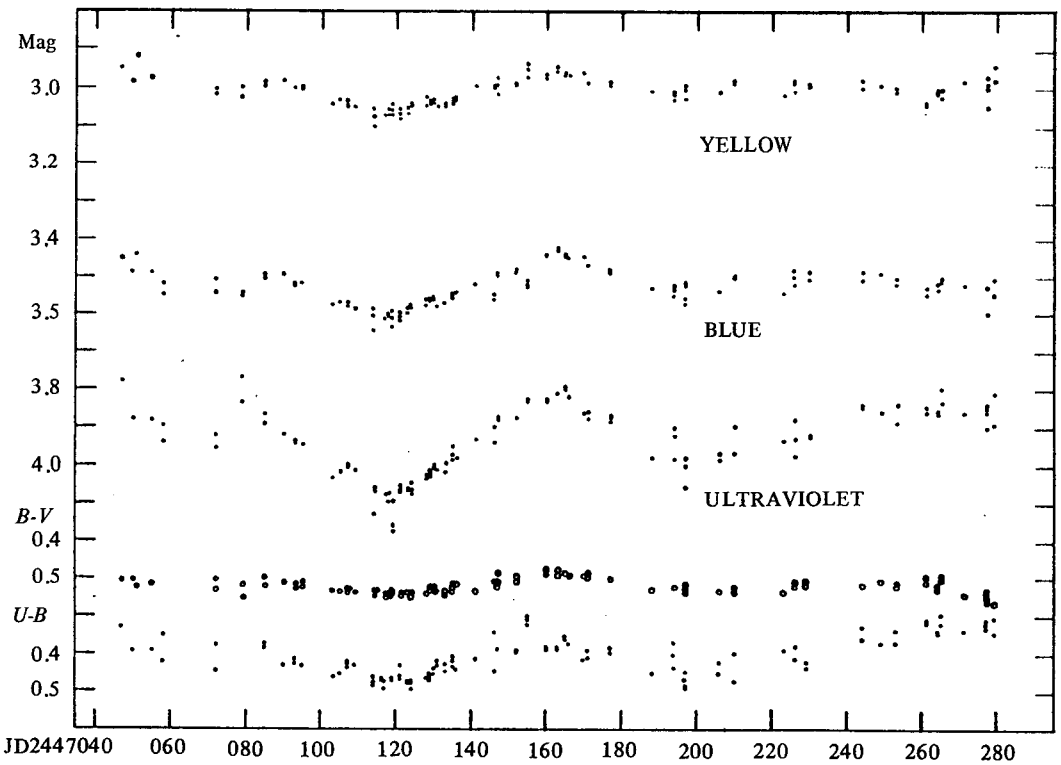

Fig. 1. Standardized *U*, *B*, and *V* light curves and color curves of Eps Aur in 1987-1988 at the Ilsan Station.

V, *B*, and *U* light curves shown on an upper part in Figure 1 can be devided into three parts, which lasted for 235 days, according to the shape of light variations. The first part, JD2447045~2447085, and the third part, JD2447163~2447280, are difficult to say something about. The second part, the duration between the two, is however interesting. The shape of light variations of this part in three passbands unanimously demonstrate a semi-regular which resembles to that of pulsation stars. Amplitudes of light variation in *V*, *B*, and *U* are 0.12, 0.19, and 0.29, respectively, and thus a colour dependency is clear. Durations of this light variation show also a mild color dependency increase with decreasing wavelength; e.g., the durations of 75 days for *V*, 77 days for *B*, and 85 days for *U* with the weighted mean of 78 days.

III. Discussion

Recently, Stub(1972) investigated the possibility of the secondary eclipse light variation of Eps Aur with data available for 1960-1968 from Copenhagen University Observatory at Brorfelde. He found no sign of the secondary eclipse, but found that the amplitude of light fluctuation decreases with wavelength and that the maximum amplitude of 0.2 is in the blue and ultraviolet as already noticed by previous workers (Huffer 1932, Gussow 1933).

The present investigation is based on the data of just four years after the 1982-84 eclipse and, thus, is not qualified for the investment of the secondary eclipse light variation as done by Stub. Nevertheless, light curves shown in Figure 1 are in phase far enough to avoid the light contribution of the unseen secondary component, and the light fluctuations detected are attributed to the F supergiant component of Eps Aur alone.

Mean light levels of Eps Aur at two intervals of time, one at the total eclipse and the other the first year after the eclipse, are deduced by Schmidtke(1985) with *UBV* observations made by J. L. Hopkins of the Hopkins Phoenix Observatory and by S. I. Ingvarsson of the Tjornisland Astronomical Observatory. These mean levels in *UBV* are compared with those of Yonsei University Observatory in Table I, and found no significant systematic differences. The last column of Table I represents the light levels in the same sense of the light curves under consideration. These are essentially the same with those as seen in 1984-85, and the ellipticity effect of F star is absent in this limited data.

If the duration of the semi-regular variation in light of Eps Aur is a result of Cepheid-like pulsation, the mean period 78 days belongs to the longest limit of pulsation period of classical cepheids

Table I. Mean light levels in *UBV*

	Totality		1984-1985		1987-1988
	Schmidtke	Nha	Schmidtke	Nha	Nha
U	4.510	4.75	3.708	3.93	3.90
B	4.307	4.35	3.600	3.50	3.51
V	3.734	3.74	3.048	2.99	2.99

(Allen 1976). Simple calculation of the distance of Eps Aur adopting $M_V=-6.4$ of Allen(1976) leads to 765pc, which is significantly smaller than 1.2 kpc adopted by Backman(1985).

It is hoped our monitoring be continued ceaselessly by future enthusiastic observers of this important, misterious binary until the year of 2009 when the star renews the previous eclipses. In the mean time, occassional reports will be presented whenever additional informations or new discoveries are available.

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