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Transient high frequency optical oscillations on a weak flare of the red dwarf UV Cet

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Abstract: In this paper the analysis of the B-light curve for a rather weak flare of the red dwarf UV Cet is presented. The results of the present study indicate that transient high frequency oscillations, not rigorously bounded, occur during the flare event and during the pre-flare state as well.

1 Introduction

Thorough investigations on the flare stars, EV Lac [7], [8],[1],[2] and [3], AD Leo [4] and [5]), EQ PegB [6] indicate that transient high frequency oscillations occur during the flare event. These results were deduced from the analysis of strong flares. Nevertheless some indications on EV Lac [2] and definite results on AD Leo [4] and [5] indicate that high frequency transient optical oscillations occur during weak flares even during the quiet state of these stars. So in this paper we investigate the presence of hight frequency oscillations in a weak flare of the active red dwarf UV Cet by analysing of the B-light curve.

2 The Data

The analysed data in this work consist of the B- light curve in relative intensities of a flare of UV Cet which was observed with the help of the 30-inch Cassegrain telescope of the Stephanion Observatory ($\lambda = 22°49'45''$, $\phi = 37°45'09''$ and $h = 900m$) which is equipped with a Johnson photometer on October 12, 2001. The digitized recording system has a recording resolution is 0.108 second. Table 1 displays the characteristics of this flare.

Table 1: Characteristics of the observed flare

Date	UT(max)	Duration (min)	$[\frac{I-I_o}{I_o}]$	σ_{BW}	sampling gap (sec)
12/10/01	$20^h30^m56^s$	3.72	2.5	0.2121	0.108

3 Analysis

The data consist of a sample of relative intensities i.e. (I-Io)/Io, where I is the flare intensity and Io is the quiet star intensity. The extent, as well as the resolution, of the observational sample permit a reliable Discrete Fourier Transform analysis of sufficient light-curve parts for the determination of possible transient oscillations in the frequency domain and their approximate location in the time domain.So the analysis comprises the following steps: (1) With the help of DFT-analysis we deduce the power spectra and the logarithmic power spectra of the flares and the quiet state star deflection. The logarithmic power spectrum will enable us to separate the random part of the spectrum from the

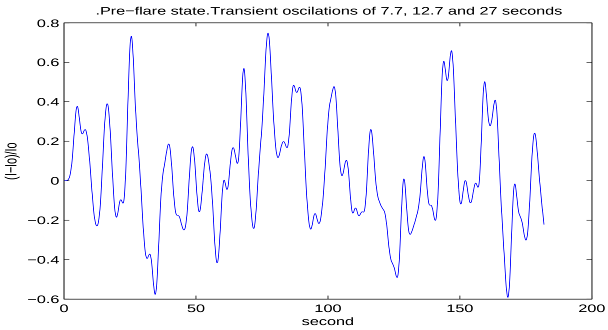

Figure 1: Transient oscillations with periods 7.7, 12.7 and 27 sec in the pre-flare state.

non random.(2) We isolate by filtering the random part of the spectrum and we estimate the standard deviation of the random noise σ_{BW}. (3) We identify the potential frequencies of star brightness oscillations from the power spectrum. To do this we use the Ho hypothesis test (see [1]) in which $\sigma = \sigma_{BW}$. (4) We filter out the identified frequencies from the star deflection. (5) We estimate the confidence level of those frequencies identifications comparing the amplitudes of the oscillations with the respective σ_{BW}.

4 Results

The analysis of our data indicate that Transient high frequency oscillations occur during the flare event and during the pre-flare state as well with amplitudes higher than 50%. Since the standard deviation of the noise is 21.21% the confidence levels of the identifications are higher than 90%. Figure 1 displays a sample of these oscillations on pre-flare state. The Observed frequencies range between 0.0093Hz (period 108 sec) and 0.231Hz (period 4.3 sec) not rigorously bounded and are of varying amplitudes. The existence of these transient oscillations during the pre-flare and the whole flare period of the weak flares, their varying magnitude and phases are in favor of the explanation which is offered by [8].

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