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Light curves of the Be stars of NGC 3766

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Abstract. Nonradial pulsations (NRPs) are a possible formation mechanism for the equatorial disks surrounding Be stars. The open cluster NGC 3766 has a high fraction of transient Be stars, Be stars that have been observed with both emission due to a circumstellar disk and a non-emitting B-type spectrum. Because of the large fraction of transient Be stars, this cluster is a prime location for studying the formation mechanisms of Be star disks. We observed NGC 3766 for more than 25 nights over three years to generate Strömgren *uvby* light curves of the Be population. We present the results of a period search to investigate the presence of NRPs.

Keywords. open clusters and associations: individual (NGC 3766), stars: emission-line, Be, stars: oscillations (including pulsations)

1. Introduction

NGC 3766 is an open cluster rich with transient Be stars (McSwain *et al.* 2008). Be stars are non-supergiant B-type stars that have exhibited emission features in the Balmer or other spectral lines at some point (Porter & Rivinius 2003).

NRPs are spherical harmonic waves that move across stellar surfaces driven from below by an opacity mechanism produced by ionized iron (Gutierrez-Soto 2007). These pulsations, in conjunction with rapid rotation, are possibly the cause of the equatorial disks surrounding Be stars (Porter & Rivinius 2003). For more discussion on the mechanisms behind NRPs, see Buta & Smith (1979).

2. Analysis and Results

We obtained Strömgren *uvby* photometric data in 2008 March and June, 2009 February and May, and 2010 March with the CTIO 0.9-m telescope. We applied standard reduction routines in IRAF using the *quadred* package. The photometric calibrations used non-variable B stars with known magnitudes from Shobbrook (1985, 1987). Balona & Engelbrecht (1986) and McSwain *et al.* (2008) list the B and Be stars we used for potential nonradial pulsation candidates. Sample b- and y-band light curves for one cluster member, No. 1 (using identifiers from the WEBDA database) over the course of one week (2010 March) are shown in Figure 1, left. With the oscillation frequencies determined by PDM (see Figure 1, right), we folded the light curves in plots of magnitude versus phase (see Figure 2).

3. Conclusions and Future Work

We find that some of the Be stars have multiple modes of NRPs, for example No. 1 (see Figures 1 and 2). The light curves and periods presented here, as well as those of many other members of NGC 3766, will be used to model NRPs. We will assume a spherically

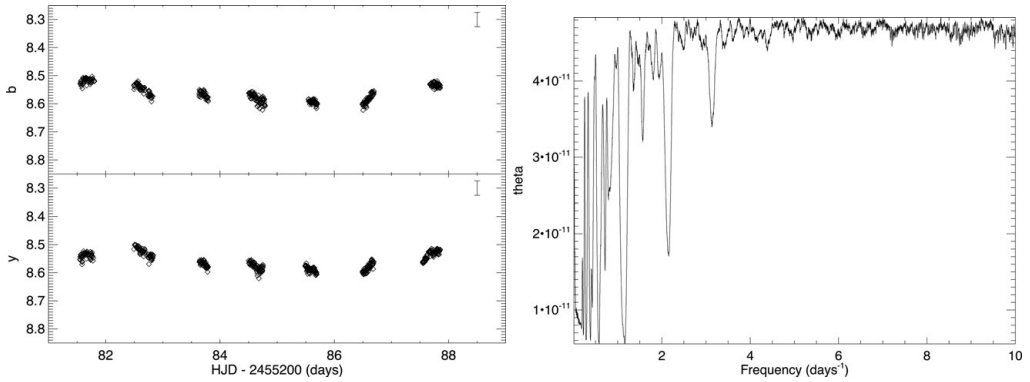

Figure 1. *Left:* Strömgren *b*- and *y*-band light curves for No. 1 from 2010 March. Representative error bars are in the upper right corner. *Right:* A sample plot of frequency versus θ, the PDM statistic for significance, for No. 1. The minima are possible frequencies of NRPs coupled with the rotation period of the star.

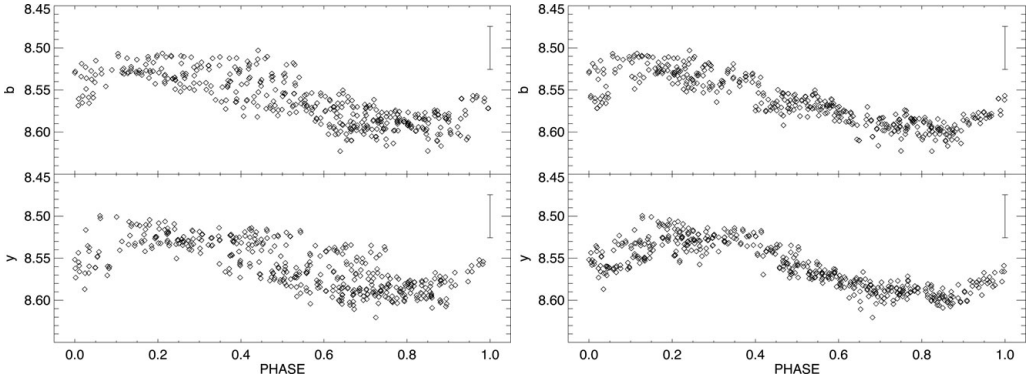

Figure 2. *Left:* Folded Strömgren *b*- and *y*-band light curves for No. 1 from 2010 March with a period of 11.16 hours. *Right:* The same light curves are folded with a period of 20.39 hours.

symmetric model of NRPs and model the observed light curves, following an element of the stellar surface as it pulsates and rotates.

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