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HD 160529: a new galactic Luminous Blue Variable

Abstract

The galactic early A hypergiant HD 160529 has been photometrically monitored in the Strömgren system during the past 18 years. Pulsation-like variations of a period of 57 days with an amplitude of 0.1 mag in y were found. In addition, HD 160529 has become fainter in the optical range by 0.5 mag during the past eight years. The decline of the lightcurve is accompanied by a change in the temperature-sensitive c_1 index of about -0.2 . HD 160529 has become visually fainter and hotter during the past eight years, exhibiting it as a new instance of a galactic LBV.

Introduction

The A hypergiant HD 160529 has been considered for a long time as one of the most luminous stars of the Galaxy, being perhaps comparable to HD 33579, the brightest A hypergiant in the LMC. Photometric and spectroscopic variations of HD 160529 have been studied in some detail by Wolf et al. (1974). Photometric observations published by Sterken (1977) showed the star to be variable by about 0.15 mag and prompted a long-term monitoring campaign.

Observations

The bulk of the photometric data consists of differential Strömgren photometry acquired at the Danish and ESO 50cm telescopes at ESO, La Silla, mainly within the "Long-Term Photometry of Variables" (LTPV) program. In addition, near-infrared photometry has been obtained at the ESO 1m telescope. The spectroscopic data consists in high-dispersion CES spectra obtained at the 1.4m CAT telescope at La Silla. The wavelength ranges of the spectra are centered around prominent lines such as $H\alpha$, $H\beta$ and $HeI\lambda 5876$.

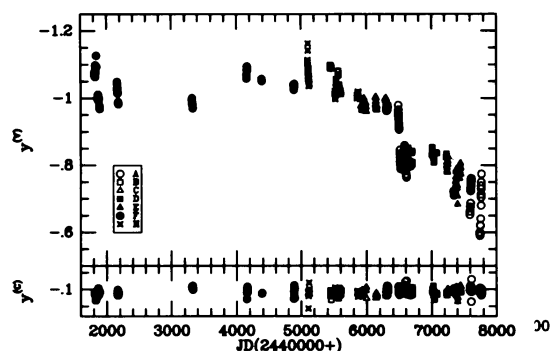


Figure 1: Differential lightcurve of HD 160529, extending over more than 6,000 days. Note the fading after JD 2445000 and the "event" near JD 2446500.

Long-term variations

Our time basis extends over more than 6,000 days. The complete lightcurve is shown in Figure 1. Before JD 2445000 the stellar brightness did not show a marked trend, afterwards it faded about linearly with a rate of about $0.055 \text{ mag yr}^{-1}$. The total amplitude so far is about 0.5 mag. Particularly remarkable is a strong fading around JD 2446500, which amounted to about 0.2

mag within 40 days. The c_1 index of the star changed during the fading by about 0.15 mag, consistent with a temperature change from about 8,000 to 10,000 K.

Short-term variations

After removing the long-term trend and the event around JD 2446500, the power spectrum of the star has two peaks at $\nu \sim 0.017$ and 0.018 d^{-1} . It turns out that these frequencies are significant. The fact that the peaks are double does not imply that the frequency is physically double. The splitting could be due to a time-dependent amplitude of the variations. After prewhitening the data with $\nu = 0.0176$, corresponding to a period of 57 days, both peaks disappear simultaneously.

Stellar parameters and mass loss

The stellar parameters characterising the maximum state are estimated from the excitation temperature and the profile of H δ to be $T_{\text{eff}} \approx 8000 \text{ K}$, $\log g \approx 0.55$. These parameters are close to the limit where hydrostatic Kurucz atmospheres exist. From the colour changes we conclude that the star during fading moves along the upper stability limit to about $T_{\text{eff}} \approx 10,000 \text{ K}$, $\log g \approx 1.05$. The luminosity is then constant. The similarity of HD 160529 with the LMC star R 110 (Stahl et al., 1990), together with the amplitude of the variability (Wolf, 1989) suggests a bolometric magnitude of -8.9, resulting in a distance of 2.5 kpc. From that the mass is estimated to be only $M \approx 13 M_{\odot}$. This small mass suggests that HD 160529 is a post-RSG object. From the H α and H β profiles and the near-infrared excess, the mass-loss rate of HD 160529 was estimated to about $10^{-5} M_{\odot}$

yr^{-1} . No significant change of the mass-loss rate with brightness could be found.

A more detailed paper about HD 160529 will be published by Sterken, Gosset, Jüttner, Stahl, Wolf, Axer in *Astron. & Astrophys.*

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