

## DETECTION OF A NEW PHOSPHORUS RICH STAR IN THE OPEN CLUSTER M6

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**Abstract.** We present the first spectroscopic analysis of HD318101, a member of the M6 (NGC 6405, age 100 Myr) open cluster, using low and high resolution ( $R \sim 7500$ ,  $R \sim 25000$ ) spectra stretching from 4500 to 5840 Å. The atmospheric parameters of the star were determined from Geneva photometry and hydrogen line modeling ( $T_e = 15400 \pm 500$  K,  $\log g = 4.0 \pm 0.25$ ). The abundances of 8 elements were determined by fitting synthetic spectral lines to the observed ones. We derived a strong overabundance of phosphorus (+1.69 dex, relative to the Sun) from several P II lines. We also found helium to be underabundant (-0.37 dex). These abundance anomalies suggest that HD318101 could be a He-weak PGa type star (CP4).

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### 1 Introduction

Non-magnetic chemically peculiar stars are divided into four main groups (Kurtz 2000):  $\lambda$  Boo (7000-10000 K, metal poor), Am (7000-10000 K, metal rich), HgMn (10000-14000 K), and He-weak PGa (13000 - 18000 K). Elemental diffusion can be the cause of these elemental peculiarities. For B stars, stellar winds might also cause some chemical peculiarities. Detailed discussions of peculiar B and A stars can be found in Alecian (1996), Kudritzki & Puls (2000), Krticka & Kubat (2004), and Gebran & Monier (2008).

HD318101 (NGC 6405 20) is one of the brightest member of the M6 open cluster. Nesterov et al. (1995) ascribed this star a spectral type B9. Johnson UBV, Strömgren *uvby*, and Geneva 7color photometric measurements of the star were published by Talbert (1965), Schneider (1985), and in the WEBDA, respectively.

### 2 Observations

The spectrum of HD 318101 was acquired with FLAMES/GIRAFFE spectrograph with MEDUSA, mounted at UT2 (Kueyen), the 8 meter class VLT telescope in May and June, 2007. The spectral regions cover three wavelength intervals: 4500-5100 Å, 5140-5350 Å, and 5590-5840 Å at resolving powers of about 7500, 25900, 24200, respectively.

### 3 Abundance Analysis

The color  $B-V = -0.03$  is calculated from Kharchenko & Roeser (2009). We derived an effective temperature ( $T_e$ ) of 15950 K using Cox (2000)'s calibrations and an averaged color excess of the cluster:  $E(B-V) = 0.15 \pm 0.01$ . We used Geneva 7color photometry as a second indicator and derived  $T_e = 15864$  K and  $\log g = 4.04$  from Kunzli et al. (1997)'s calibrations (CALIB code). We also used synthetic profiles of the  $H\beta$  line to obtain more accurate atmosphere parameters, and derived  $T_e = 15400 \pm 500$  K and  $\log g = 4.00 \pm 0.25$ . Model atmospheres were calculated using ATLAS9 on Linux (Kurucz 1993, Sbordone et al. 2004, Sbordone 2005). The linelist was first constructed from Kurucz's gfall.dat, and then updated with VALD and NIST. Synthetic spectra were computed using SYNSPEC48 (Hubeny & Lanz 1992), assuming Grevesse & Sauval (1998)'s solar chemical composition.

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