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New Luminous Blue Variables in M31

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Abstract. We performed spectroscopy of four Luminous Blue Variable (LBV) candidates and two known LBV stars (AE And and Var A-1) in M31. We observed the same-epoch infrared and optical spectra of these stars in October of 2011. The infrared spectra are taken with Triplespec spectrograph at the 3.5-meter telescope at Apache Point Observatory, and the optical spectra are obtained with the Russian 6-m telescope at the Special Astrophysical Observatory. All our candidates show typical LBV features in their spectra: broad and strong H-alpha emission together with other hydrogen, HeI, FeII and [FeII] lines. We confirm clear photometric variability in two our candidates. The bolometric luminosities of our candidates are similar to those of known LBV stars in the Andromeda. At least these two variables, and potentially all of the observed candidates, have to be classified as LBV stars.

Key words. Stars: abundances – Stars: early-type – Stars: variables: LBV – Galaxies: individual(M31)

1. Introduction

Luminous Blue Variables are the most massive known evolved stars that can be studied at extragalactic distances. Studying LBVs in nearby galaxies gives a benefit of having all stars at the same known distance. At the same time, their spectra are less affected by the dust attenuation in the comparison with LBVs in the plane of the Milky Way. We took optical and NIR spectra of LBV stars and LBV candidates in M31 in order to study a uniform group of these stars and to take an advantage of their known distance and small interstellar extinction. Our goal is to describe and classify the spectra, especially those in the NIR, because the NIR spectra of LBVs are not well studied yet (Voors et al. 2000; Groh et al. 2007).

We selected our candidates from a list by (Massey et al. 2007) where the authors identified 24 LBV candidates in M31.

2. Observations and results

The near-infrared spectra were taken with the 3.5-meter Telescope (Apache Point Observatory, USA) with NIR spectrograph TripleSpec in September 2011. Its spectral range is 0.95-2.46 um and its mean resolution is R = 3500. The optical spectra were obtained at the Russian 6-m tele-

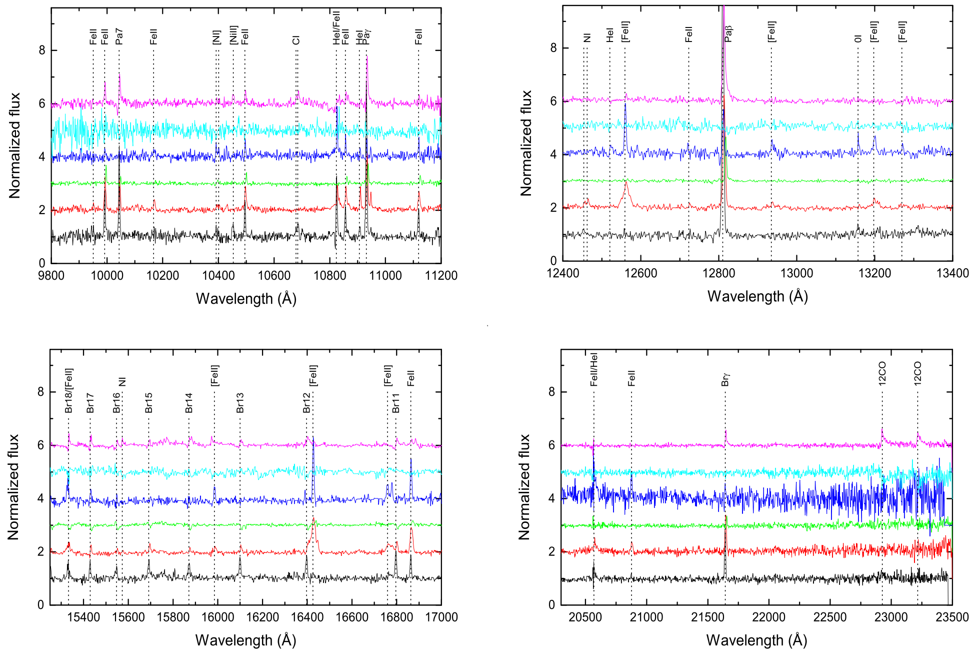

Fig. 1. Spectra of four LBV candidates and two well-known LBVs in M31 (from top to botton): J004444.52+412804.0, J004350.50+414611.4, AE And, J004526.62+415006.3, Var A-1 and J004417.10+411928.0.

scope BTA with SCORPIO (Afanasiev& Moiseev 2005) spectrograph in October-November 2011. The spectral range covered was 4000 – 7500 A with resolution R=1000. We detect photometric variability between (Massey et al. 2007) observations (October 2000 and September 2001) and our observation. Objects J004526.62+415006.3 and J004444.52+412804.0 show the V band brightness change of 0.5 and 0.3 mag, respectively. The LBV stars Var A-1 and AE And changed their brightness by 0.5 and 1.2 mag for the same time span. J004350.50+414611.4 has also been suspected to be variable (Vilardell et al. 2006; Bonanos et al. 2003). Our LBV candidates show typical LBV spectra (Fig. 1). There are broad hydrogen (Balmer, Paschen, Brackett) emission components accompanied by a forest of FeII and [FeII] emission lines. Hotter stars have HeI lines in their spectra as well. J004444.52+412804.0 and J004417.10+411928.0 show typical P Cyg line profiles.

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