LOW–METALLICITY BLUE COMPACT DWARF GALAXIES DISCOVERED IN THE HAMBURG/SAO SPECTRAL SURVEY

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We present results of the spectrophotometric study of some of the most metal-deficient blue compact dwarf (BCD) galaxies discovered in the course of the Hamburg/SAO spectral survey. These findings might have important implications in the studies of the cosmological problems, origin of the elements and massive star evolution.

INTRODUCTION

The studies of various types of galaxies with strong current star formation (SF) are among the most popular in extragalactic astronomy. It is very important to deal with large enough and well selected samples of such objects, in particular, the studies of SF bursts in low-mass galaxies (H II–galaxies, or blue compact dwarf galaxies). There are two large BCD samples on the northern sky, each covering about 1000 sq. degrees. The first one is situated in the zone of the Second Byurakan Survey (SBS) (R. A. = 7^h40^m – 17^h20^m, Dec. = +49° – +61°). The second one is under completion and is situated in the region, which is a part of the zone of Case objective prism survey (R. A. = 8^h00^m – 16^h20^m, Dec. = +29° – +38°). The new Hamburg/SAO survey for emission-line galaxies (ELG) [9] is intended to cover the region in the gap between the regions of SBS and Case survey and to create a new BCD sample in that region.

More than 800 ELGs have been discovered in Hamburg/SAO survey. Several very metal-deficient blue compact dwarf galaxies with the heavy element mass fraction $Z \leq Z_\odot/20$ have been discovered. One of these BCDs, HS 0822+3542, was discovered by Pustilnik *et al.* [8]. Kniazev *et al.* [6] have shown that its oxygen abundance is less than 1/30 solar. Hence, HS 0822+3542 is the third most-metal deficient BCD known, after I Zw 18 and SBS 0335-052.

SPECTROSCOPIC AND PHOTOMETRIC DATA

The very blue colours of the disc $(B-V)_0 = 0.06 \pm 0.06$ mag and $(V-R)_0 = 0.26 \pm 0.09$ mag in HS 0822+3542 are reasonably consistent with the predictions for an instantaneous SF burst with a Salpeter IMF, a metallicity of 1/20 $Z_\odot$ and an age of ∼100 Myr [7]. If prolonged star formation is assumed, then the age of the oldest stellar population in the extended disc can be larger than that of the instantaneous burst. The observed colours can also be explained by continuous SF with a constant star formation rate from 500 Myr to 20 Myr ago. However, older stellar populations with an age of 10 Gyr are excluded. The derived age is somewhat lower for the outermost part of the of the disc with a bluer $(V-R)$ colour in comparison to its average value.

In Fig. 1 we show the 10-m W. M. Keck telescope spectrum of the brightest knot with active star formation and a very blue continuum. The continuum of the extended underlying galaxy is also blue. Very high signal-to-noise ratio spectrum (Fig. 1) has allowed us to discover the broad stellar emission feature which is attributed to the Wolf-Rayet stellar population. This stellar population is relatively common in BCDs (*e.g.*, [2]), however, very few most metal deficient BCDs are known to contain WR stars. Our finding makes HS 0822+3542 the fourth known BCD with heavy element abundances $\leq Z_\odot/20$ and WR population, after I Zw 18 [4, 7] SBS 0335–052 [3] and Tol 1214–277 [1]. We use the intensities of the emission lines to derive the abundances of the ionized species and the total abundances of O, N, Ne, S, Ar and He. We confirm the very low metallicity of HS 0822+3542

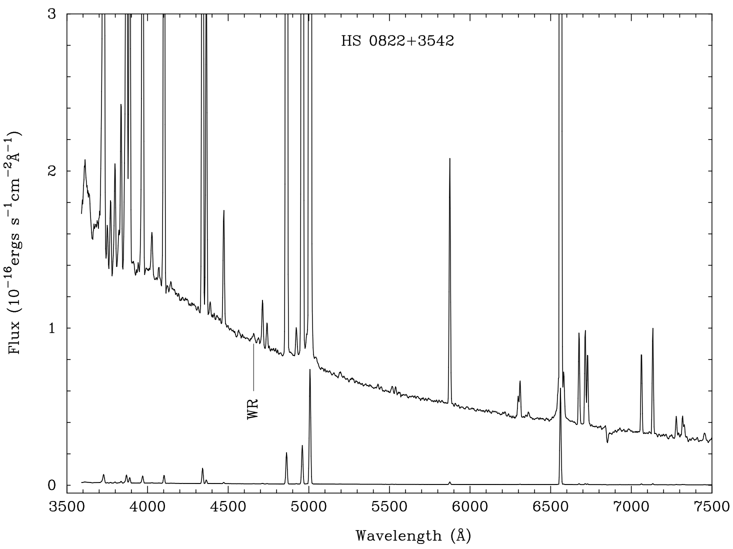

Figure 1: The 10-m W. M. Keck telescope spectrum of the brightest region in HS 0822+3542. The bottom spectrum is the spectrum divided by a factor of 100. The broad Wolf-Rayet feature is marked

derived by Kniazev *et al.* [6]. However, much better quality of the 10-m W. M. Keck telescope spectrum allows us to derive element abundances with much better precision. Our oxygen abundance in HS 0822+3542 is only $Z_\odot/30$, or slightly larger than the value $Z_\odot/35$ quoted by Kniazev *et al.* [6]. Other heavy element abundances relative to oxygen are in very good agreement with mean values for most metal deficient galaxies [5]. Very low metallicity of HS 0822+3542 makes it one of the best objects in the determination of the primordial helium abundance. Our derived value $Y = 0.244 \pm 0.005$ of the helium mass fraction in HS 0822+3542 is in excellent agreement with the Y determinations in other BCDs [3].

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