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# Oxygen Abundance and Stellar Populations in the Three Most Metal-Deficient Emission-Line Galaxies Known in the Local Universe: SBS 0335-052 E, SBS 0335-052 W and I Zw 18

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We present new spectroscopic observations of the system of the two blue compact dwarf (BCD) galaxies SBS 0335-052 W and SBS 0335-052 E with the 3.6m ESO telescope. The oxygen abundance in SBS 0335-052 W was determined to be $12 + \log(\mathrm{O/H}) = 7.13 \pm 0.08$, confirming that this galaxy is the most metal-deficient emission-line galaxy known. We find that the oxygen abundance in SBS 0335-052 E varies from region to region in the range from 7.20 to 7.31, suggesting the presence of an abundance gradient over a spatial scale of ∼1 kpc. Signatures of early carbon-type Wolf-Rayet stars are detected in cluster #3 of SBS 0335-052 E, corresponding to the emission of 20 to 130 WC4 stars, depending on the adopted luminosity of a single WC4 star in the CIV $\lambda$4658 emission line (Papaderos *et al.* 2006).

Aditionally, we study the evolutionary status of another extremely metal-deficient Wolf-Rayet galaxy, I Zw 18 ($12+\log(\mathrm{O/H}) = 7.17 \ldots 7.22$; Thuan & Izotov 2005), based on the analysis of deep HST ACS data with the point-source photometry package DOLPHOT. Our goal is to study the oldest stellar populations in this BCD and search for red giant branch (RGB) stars. A detailed analysis of the derived color-magnitude diagrams (CMDs), that reach ∼29 mag in $V$ and $I$, has led us to the following conclusions (Yakobchuk & Izotov 2006, Yakobchuk *et al.* 2006):

**i)** there is no substantial population of RGB stars in the CMDs of I Zw 18's main body and C component. Probable RGB stars are hard to distinguish from the asymptotic giant branch (AGB) stars and have very blue colors ($V$–$I$≈1.05 mag in the main body) for the given metallicity of Z=0.0004. **ii)** the population of RGB stars is not dominant in the CMD of the halo of I Zw 18, implying that all stars in I Zw 18 are quite young and have not yet diffused over a large volume. I Zw 18 appears therefore to be the only known galaxy without a halo of old stars. **iii)** the apparent magnitudes of the tip of the red giant branch (TRGB) for the main body and the C component of I Zw 18 differ by 0.7 mag. Using the theoretical dependences of the $M_I$(TRGB) on the age and the color (Girardi *et al.* 2000), this contradiction can be resolved if we assume that the formation of the RGB stars in I Zw 18 is not yet finished and the red giants have different ages in the main body and the C component.

Girardi *et al.* 2000, A&AS, 141, 371 · Papaderos *et al.* 2006, A&A, 454, 119 · Thuan, T.X. & Izotov, Y.I. 2005, ApJS, 161, 240 · Yakobchuk T. & Izotov Y.I. 2006, *Kinematics and Physics of Celestial Bodies*, in press. · Yakobchuk, T. *et al.* 2006, in prep.

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