Probing the Merging Blue Compact Dwarf Galaxies from Element Abundances and Star Formation Rate

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ABSTRACT We present elemental abundances of 91 blue compact dwarf galaxies (BCDs) at z=0.2~0.35 using Sloan Digital Sky Survey (SDSS) DR7. We derive various element abundances using Te method. We found that nitrogen to oxygen abundance of BCDs showing disturbed features are more enriched than normal BCDs owing to the contribution of W-R stars and fast rotating young massive stars in the galaxy. On the other hand, oxygen abundances for disturbed BCDs are slightly lower than the normal BCDs. This might be resulted from the dilution by infall of metal-poor gas during the interaction. We estimate Hα & NUV star formation rate (SFR) from the SDSS DR7 and GALEX GR6 data. Disturbed BCDs also show systematically lower Hα to NUV SFR ratio. Considering element abundance anomalies and distinct SFR ratios, we suggest that disturbed BCDs experience prolonged star formation histories due to the episodic dynamical event with neighboring object.

Sample & Analysis

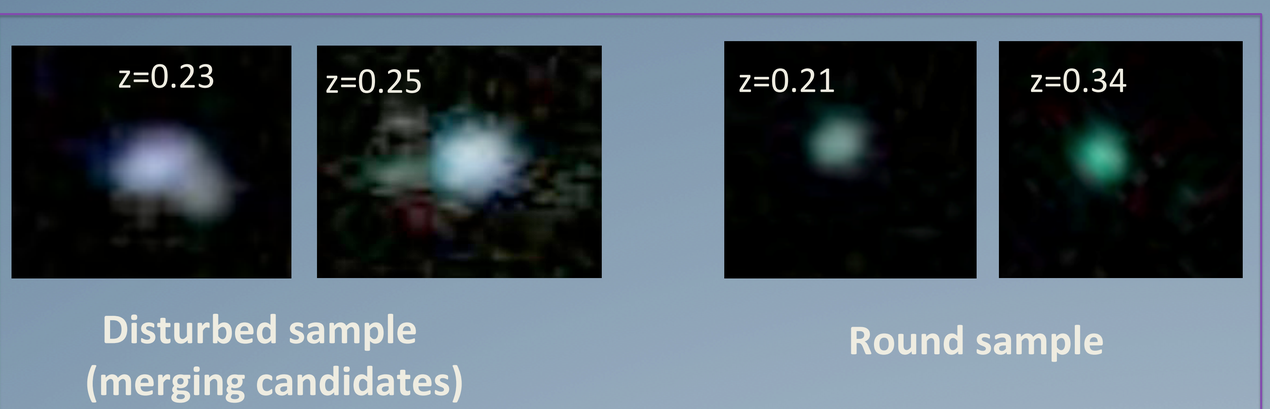
✔ We selected disturbed (merger candidate) galaxies (eg., tidal tail, double core) via visual inspection from SDSS DR7 images at z=0.2~0.35.

✔ We derived element abundances with *Te* method.

✔ We classified Wolf-Rayet (WR) feature with blue bump.

✔ We derived Hα & NUV SFRs ← internal extinction were corrected (using Balmer decrement)

✔ We derived light fraction of stellar population age from the STARLIGHT code.

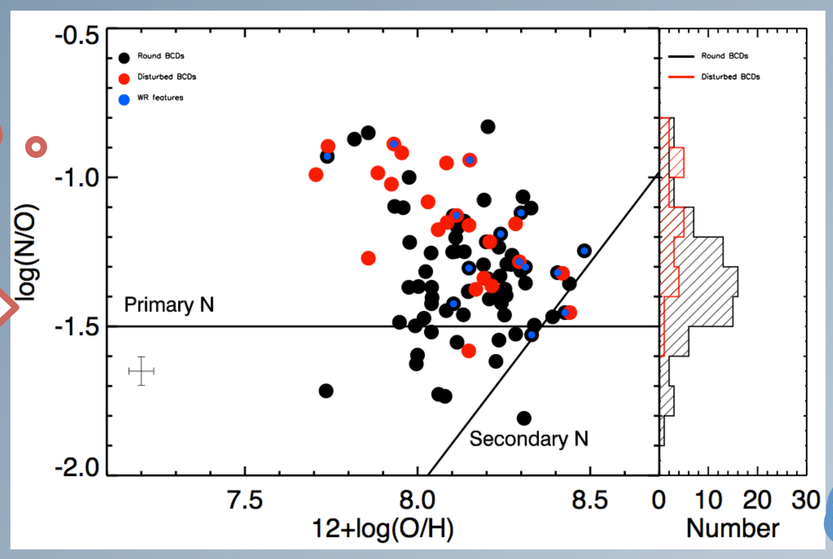


Results

Pustilnik et al. (2004) suggested that galaxies showing large nitrogen excess could be related with galaxy **merging** when **WR** stars contribute to ISM.

Nitrogen Enrichment of Disturbed BCDs

Most disturbed BCDs display systematically higher N/O values at a given O/H value compared to the undisturbed BCDs in which disturbed BCDs consist of an upper envelope of whole distribution. However, WR features are detectable for only a handful sample of our disturbed BCDs. This indicates that a difference of recent (< 1 Gyr) star formation history might be responsible for the occurrence of WR stars and, consequently, the difference of chemical abundances.

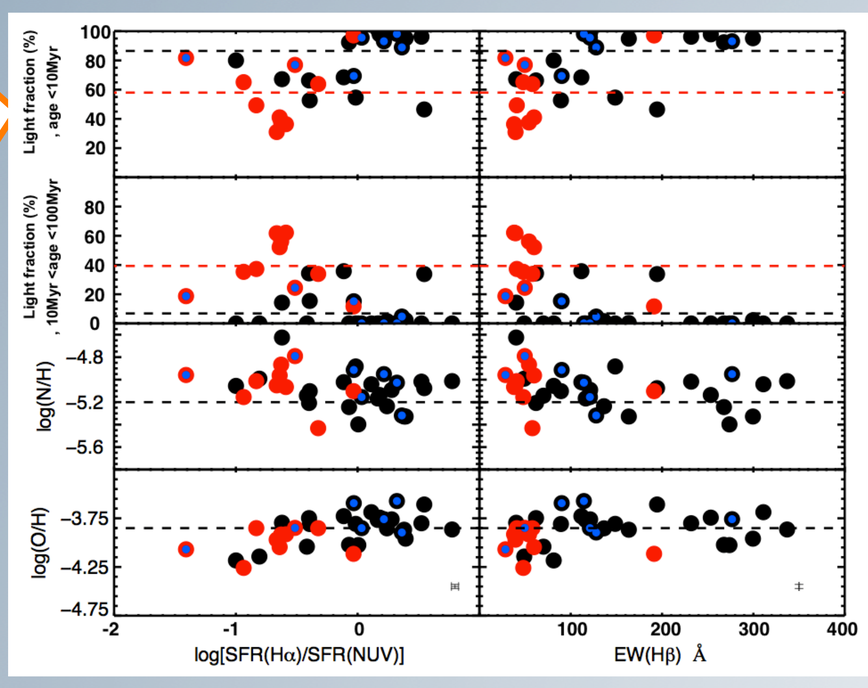


Gas Infall through the Merging

Some studies suggest that merger galaxies have lower oxygen abundances due to the infall of metal-poor gas. Peeples et al. (2009) suggested that merger candidates have systemically lower *O/H* values than normal BCDs in the luminosity-metallicity relation. Moreover, this effect is not only reveal in dwarf galaxies but in massive galaxies (Rupke et al. 2008, 2010; Kewley et al. 2010).

Stellar Population

We quantified the contribution of the young stellar populations for disturbed and undisturbed BCGs using the STARLIGHT code ,which is useful to confirm their duration of star formation episode. We estimated light fraction of young (<10Myr) and older (10Myr<age<100Myr) stellar population. Interestingly, merger candidates appear to show systemically lower fraction of young stellar population compared to the undisturbed sample.



Low O/H of Disturbed BCDs

We confirm the result of previous observational results that the disturbed BCDs exhibit systematically lower O/H values than normal isolated ones. the result of low O/H values of some disturbed BCGs of our sample would be possibly explained by the dilution of oxygen abundances due to the local environmental effect.

Star Formation Rate and EW(Hβ)

Hα emission declines more rapidly than UV continuum light with time, and Hα to NUV SFR ratio would decrease as a function of age. It is striking that the Hα to NUV SFR ratios of disturbed BCGs (red filled circles) are evidently different to those of undisturbed counterparts (black filled circles); disturbed BCGs show quit lower Hα to NUV SFR ratios than undisturbed ones.

The distribution of Hβ equivalent width, EW(Hβ), which is also suggested as an indicator of the age of the latest burst of star formation in the galaxy. It is clearly seen that the disturbed BCGs show also systematically lower EW(Hβ) than the undisturbed ones, implying a significant fraction of a non-ionizing underlying older stellar population which contributes to the stellar continuum.

Summary

✔ We found that nitrogen abundances of morphologically disturbed BCDs are abnormally quite higher (0.5~0.6dex) than those of normal BCDs.

✔ Disturbed BCDs appear to show systemically lower fraction of young stellar population compared to the undisturbed sample. They also show quit lower Hα to NUV SFR ratios and systematically lower EW(Hβ) than undisturbed ones.

✔ We suggest that the dynamical process of merging or interactions would play an important role in element abundance enrichments as well as in star formation history. This implies that merging BCDs should experience prolonged star formation histories through the episodic dynamical events between two galaxies.