Spectroscopic and Photometric Studies of Blue Compact Dwarf Galaxies I. Merging Scenario and Evolutionary Connections

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We compare the structural and photometric properties of faint underlying low surface brightness components of BCDs with other dwarf galaxies and normal galaxies. The results are as follows:

(1) Pure disks of BCDs are classified into two groups, low-surface-brigtness (LSB) BCDs and high-surface-brightness (HSB) BCDs on the diagram of the central surface brightness-absolute magnitude. LSB BCDs show a similar trend to low-surface-brightness dwarf irregulars (LSB dIs), dwarf ellipticals (dEs), and spirals on the disk scalelength-absolute magnitude diagram. This is consistent trend with previous studies, but BCDs have a more wide distribution than dIs or dEs on the scale length-absolute magnitude diagram. The existence of BCDs with extreme small scalelength from comparable size to that of dIs and dEs, and the intermediate stage suggest that there are multi-folds of BCDs at the point of view of galaxy structures.

(2) Pure disks of dwarf galaxies can be classified as three different groups on the color-magnitude diagram. Most of dIs are located on the bluer Group A with (B-I)=0.5mag, while most of BCDs and dEs are placed on the intermediate Group B with (B-I)=1.4mag. Spirals and normal Es are placed redder region than the redder Group C of dwarf galaxy with (B-I)=2.2mag.

(3) We calculate a single burst population model for a galaxy with mass 1×10^9 $M_\odot$ and (Fe/H) = -1.7 and -1.0 from 0.001 to 10 Gyr. On the M_B^T - (B-I) plane, both of two galaxies with different metallicity show same trend to evolve to the central line of the Group B. This is an possible explanation of why most of dwarf galaxies to be a member of the Group B.

We also make a simple merging model. In this model, we assume 2 identical galaxies with the mass of 1×10^9 M$\odot$, the metallicity of (Fe/H) = -1.0, and the age of 1.0 Gyr would merge and well mixed stars within 0.1 Gyr. Then which 10% stars of the total mass of galaxy would newly form during merging, and the merger tends to evolve to the central line of the Group B before 1 Gyr, and along the central line of the group next 5 Gyr on the both of color-magnitude diagrams.

This suggest that galaxy merger and the population evolution could be an possible explanation why dwarf galaxy tends grouping and has a wide distribution on the color-magnitude diagrams.

We will discuss evolutionary connections between BCDs, dIs, and dEs from structural and photometric properties, morphology and spectroscopic evidences, and intrinsic shapes.