Luminous Compact Blue Galaxies in the Local Universe: A Key Reference to High Redshift Studies

Jorge P. Gallego1, Rafael Guzmán1, Francisco J. Castander2, C. A. Garland3, D. J. Pisano4

1Department of Astronomy, University of Florida, Gainesville, USA
2Institut d’Estudis Espacials de Catalunya/CSIC, Barcelona, Spain
3Natural Sciences Department, Castleton State College, Vermont, USA
4Australia Telescope National Facility, Epping, Australia

Overview

Luminous Compact Blue Galaxies (LCBGs) are small starburst systems that dominate the number density of galaxies at intermediate redshifts. The most comprehensive study of LCBGs at intermediate redshift to date is that of Phillips et al. (1997) and Guzmán and Castander (1997), which concluded that the LCBG class is populated by a mixture of starbursts. About 60% of galaxies in their sample are classified as “HII-like” since they are similar to today’s population of luminous, young, star-forming HIII galaxies. The remaining 40% are classified as “SB disk-like” since they form a more heterogeneous class of evolved starbursts similar to local starburst disk nuclei and giant irregular galaxies.

Recently, various observational studies have highlighted the key role that LCBGs play in galaxy evolution over cosmological time-scales. For instance, (i) LCBGs contribute the most to the evolution of the blue Lgx galaxies in the last ~ 8 Gyr (Lilly et al. 1994, Málaga-Orejas et al. 1999); (ii) LCBGs are a major contributor to the observed increase in the star formation rate density of the universe at z ~ 1 (Guzmán et al. 1997), and (iii) LCBGs may be the lower mass counterparts of the luminous galaxy population at z ~ 3 (Lev鸬nthal et al. 1997, Kotake et al. 1999; Sawicki & Yee 1998).

Interest in LCBGs has multiplied following the initial results of studies using 3-D spectroscopic observations obtained over a very wide range in wavelength using WIYN/DENSEPAK in optical, FISICA in infrared, and VLA in cm. Together with photometric observations from FUV to mid-IR and FLAMINGOS-2 at GEMINI-S, that will systematically survey the rest-frame optical properties of the high-z galaxy population.

Figure 1: Optical brightness vs. IR (3.6 μm) diagram suggests the population consists of two groups (including Luminous, Broadened and Local LCGs). (a) 2009 redshift values and optical properties of LCGs in our sample. See figure 1 to compare with current and future surveys of similar galaxies at high redshift, including the population of Lyman-break galaxies. In this conference, we present preliminary results of this study using 3-D spectroscopic observations obtained over a very wide range in wavelength using WIYN/DENSEPAK in optical, FISICA in infrared, and VLA in cm.

Figure 2: The spectral energy distribution of SDSSJ0124+0050. Superimposed is the fiber array of DENSEPAK. (a) Map of the velocity field of SDSSJ0124+0050 using Hα and its companion. The beam is shown in the lower left corner. (b) Metallicity map of mrk538 derived using N2 index (Pettini & Pagel). Higher metallicity regions are located in the center of the galaxy. (c) Star formation rate 2 index (Pettini &

Figure 3: Map of the velocity field of SDSSJ00834+0139 (right) and its companion. The bar indicates the direction of the rotation. The beam is shown in the lower left corner. (a) SDSS visible image of SDSS J0124+0050. Superimposed is the fiber array of DENSEPAK. W e are mapping the central region of the galaxy, further observations will focus on the outer regions.

Figure 4: We estimate a rotational velocity of at least 47 km s^-1 c to the LCBG, when using unresolved maps from the molecular and the neutral atomic gas.

References