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SPECTROSCOPY OF LUMINOUS BLUE COMPACT GALAXIES AT INTERMEDIATE REDSHIFT

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RESUMEN

Presentamos resultados preliminares del estudio espectroscópico con resolución espacial de HER1-13385, una galaxia azul, luminosa y compacta (LBCG) con un desplazamiento al rojo de 0.1. Los espectros se obtuvieron con el telescopio espacial Hubble utilizando STIS/CCD. El objetivo fundamental de este trabajo es investigar la cinemática y la distribución espacial de la zona de emisión en LBCGs a desplazamientos al rojo intermedios.

ABSTRACT

We present preliminary results from spatially-resolved spectra of HER1-13385, a Luminous Blue Compact Galaxy (LBCG) at redshift 0.1. The spectra were obtained with HST using STIS/CCD. The main goal of this work is to investigate the kinematics and spatial distribution of the emission region in LBCGs at intermediate redshifts.

Key Words: **COSMOLOGY : OBSERVATIONS — GALAXIES : DWARF — GALAXIES : STARBURST**

1. INTRODUCTION

The nature of luminous blue compact galaxies (LBCGs) and their relation to today's galaxy population is still largely unknown, but it has been established that this galaxy class is a mixture of starbursts. About ∼60% are like star forming, low mass H II galaxies, and the remaining are classified as "SB disk-like", similar to local starburst disk nuclei and dwarf irregular galaxies. This classification is consistent with that of Koo et al. (1994, 1995) and Guzmán et al. (1996, 1998), who first established the association between H II galaxies and LBCGs for their sample of Compact Narrow Emission Line Galaxies (CNELGs). Alternatively, Mallén-Ornelas (1999) and Hammer et al. (2001) have concluded that their LBCG samples can be best identified with more massive systems such as bright irregulars, late-type spirals, or disk galaxies with a young bulge.

In order to shed light on the nature of LBCGs, we have obtained STIS spectra for a sample of five LBCGs at redhifts $z = 0.1$–0.4. These spectra will allow us to calculate dynamic masses from spatially resolved rotation curves, as well as the characteristics of the emission region across the galaxy (e.g., dust content, metallicity, and star formation rate).

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2. OBSERVATIONS

Two different instrumental setups were used: 1) a slit width of 0.5″ with the grating G750L which provides a dispersion of 4.92 Å/pix and 2) a slit width of 0.2″ with the grating G750M which provides a dispersion of 0.56 Å/pix. Configuration 1 will be used to measure emission line fluxes for [O II] λ3727 , Hβ, [O III] $\lambda\lambda$4959,5007, and Hα in several locations within the galaxy. Configuration 2 will be used to study galaxy kinematics from the centroid and width of Hα.

3. DATA REDUCTION

The spectra have been reduced using the STSDAS (Space Telescope Science Data Analysis System) package available within IRAF. The reduction process is different for each configuration. Configuration 1 spectra are processed in the following steps: bias subtraction, flat-fielding, cosmic-ray rejection, defringing, wavelength calibration, S-distortion correction and flux calibration. To remove the fringes that appear redwards of ∼8000 Å, we use a special flat frame made from a contemporaneous CCD-flat that was taken just before each spectra. The fringes that appear on the flat frame are matched to those that are present in the actual spectra, and the fringes are corrected by subtracting the flat from the spectra. Configuration 2 spectra are processed in a similar way but do not need to be defringed.

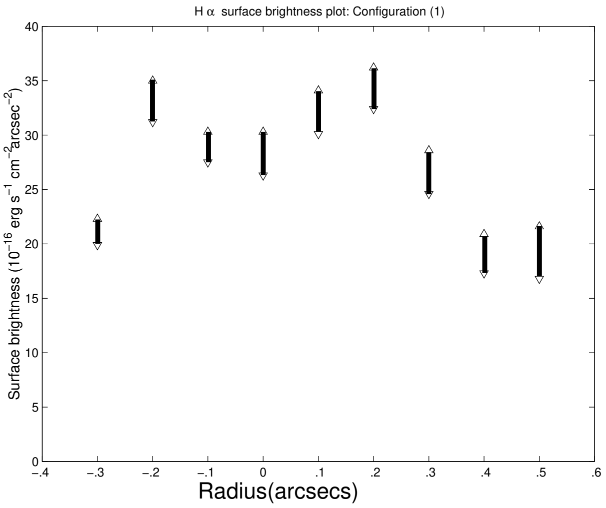

Fig. 1. Surface brightness plot for HER1-13385 from Hα data. The given luminosity is calculated with $H_0 = 50$ km s^{-1} Mpc^{-1} and $q_0 = 0.05$.

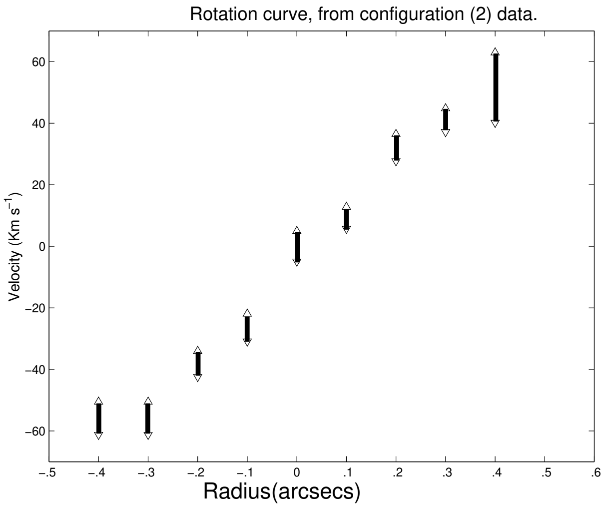

Fig. 2. Rotation curve for HER1-13385, from Hα data. The derived rotational velocity $v_{\rm rot}$ is used to estimate the dynamical mass: $M \times (\sin i)^2 = (2/\pi) \times (v_{\rm rot}^2 R_{25}/G)$. R_{25} was computed with $H_0 = 50$ km s^{-1}Mpc^{-1} and $q_0 = 0.05$.

4. PRELIMINARY RESULTS

For the closest LBCG in our sample, HER1-13385, nine one-dimensional spectra $0.1''$ wide were extracted in each configuration. In configuration 1 [O III] λ5007 and Hα lines are available for measurements (see Figure 1) The surface brightness in these two wavelengths was measured. In configuration 2, only Hα was available. The surface brightness of this emission line, along with the central wavelength of each extraction was measured, and a rotation curve (Figure 2) was constructed. The emission line luminosities are: $L_{{\rm H}\alpha} = 4.68 \times 10^{40} \pm 1.2 \times 10^{38}$erg s^{-1}—an order of magnitude greater than typical giant H II regions—and $L_{\lambda 5007} = 2.759 \times 10^{40} \pm 1.9 \times 10^{38}$erg s^{-1}. The galaxy's dynamic mass calculated using the rotation curve shown in fig 2 is: $M \times (\sin i)^2 = 9.4 \times 10^8 \pm 1.7 \times 10^8\ M_\odot$. This value is consistent with that previously published by Koo et al. (1995), based on emission line velocity widths.

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