RevMexAA (Serie de Conferencias), **24**, 227–228 (2005)

STELLAR MASSES OF STAR-FORMING GALAXIES AT $0.3 < z < 1.2$ IN THE GOYA SURVEY

D. Cristóbal-Hornillos,[1] M. Balcells,[1] M. Prieto,[1] R. Guzmán,[2] C. Eliche-Moral,[1] P. Erwin,[1] and L. Domínguez-Palmero[1]

Starforming galaxies with compact morphology and high optical luminosity (LBCGs) are very common at redshitfs $z = 0.4 - 1.2$. Those galaxies are believed to have evolved more than other galaxy class during the last $\sim$ 8 Gyr, and are a mayor contributor to the global star formation rate density of the universe at $z \sim 1$. A robust way to gauge their evolution is throught quantities that do not change much when the star formation activity ceases. In this poster we present the stellar mass measurements for a sample of 30 LBCGs from the GOYA photometric survey. The stellar masses are obtained by fitting the photometry in $UBVIJK$ filters to a two component galaxy population model obtained with GISSELXXI.

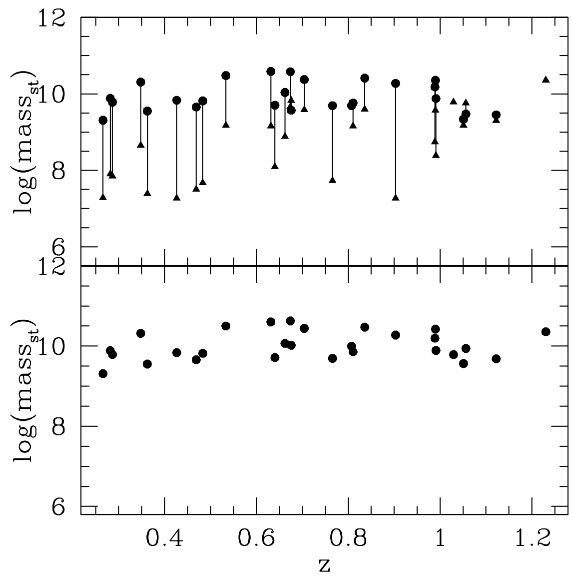

Fig. 1. Stellar masses for the LBCG sample, obtained using Salpeter IMF, LMC extinction law with $A_V = 0.3$, $Z = 0.4 Z_\odot$ and $\tau = 1$ Gyr. Triangles correspond to the burst component and circles to the underlying population.

Photometric and redshift data

The photometric catalog used in this poster was obtained from GOYA photometry in the Groth-Westphal strip (Groth, Kristian, Lynds et al. 1994). The field consists of 28 WFPC2 pointings, defining a linear strip on the sky at position angle 40.06°, centered on $RA = 14^h16^m38^s8$, Dec $= 52°16'52''$ (J2000).

Near infrared GOYA observations were carried in the J, Ks bands using the NIR camera INGRID on the William Hershel Telescope. Optical data in U and B filters were obtained with the WFC on the Isaac Newton Telescope. We combined our optical and NIR data with WFC2/HST photometry in the $F606W$ and $F814W$ filters, and spectroscopic redshifts from the DEEP public catalog, to correctly apply the K-correction.

The LBCG sample selection is carried as a function of luminosity, color and surface brightness of the sources. The luminosity cut corresponds to $M_B < -18.5$, for a starburst-like spectra. The color cut is that of a late spiral galaxy $B - V < 0.6$. The surface brightness limits corresponds to $BS_e < 21$ mag arcsec^{-2} in the B band.

The stellar-mass fitting code

Stellar masses are estimated by fitting the observed photometry to the model photometry obtained from the convolution of a synthetic galaxy spectrum with the filter transmission functions.

The two-component synthetic galaxy consists of a young burst, modeled by a single star population, and an underlying population created with an exponentially decreasing SFR. GISSELXXI (Bruzual & Charlot 2003) is used to create the two galaxy components at different ages, as function of the model parameters: IMF, SFH, metallicity and extinction.

Once the model parameters are fixed, the fitting procedure determines which combination of stellar masses and ages for the components produces a best fit to the observed photometry. Changing the model parameters from one realization to another allow to

[1]Instituto de Astrofísica de Canarias (IAC), Spain (dch@ll.iac.es).
[2]University of Florida, USA.

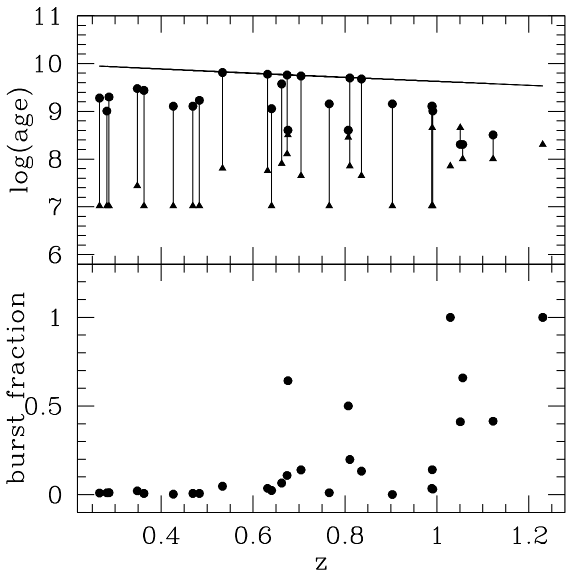

Fig. 2. Ages of the component vs. z, triangles correspond to the burst component and circles to the underlying population. The lower panel shows the mass fraction in the recent burst of star formation.

infer which combination produces the best fits for the whole sample, thus giving a statistical estimate for the IMF, SFH, metallicity, extinction law and E(B-V).

Results and discussion

The models that provide better fits for the LBCG sample are those with Large Magallanic or Milky Way extinction laws, and $E(B-V) < 0.2$. Stellar masses and the χ^2 for the fit, neither change remarkably with the e-folding star-formation timescale τ of the underlying component nor with the IMF, despite the same mass limits are considered. The results presented here are for $Z = 0.4Z_\odot$ that match the range o metallicities for LBCGs at intermediate redshifts given in Guzmán, Koo, Faber & Illingworth (1996) and Kobulnicky & Zaritsky (1999). Figure 1 shows the resulting stellar masses for the LBCG sample, and Figure 2 shows the age of each component and the burst to underlying stellar mass ratio.

The mean stellar mass for the sample is $\sim 10^{10}\,M_\odot$, and stellar masses of individual objects range from 2×10^9 to 5×10^{10}. As A_V changes from 0 to 0.6, the mean inferred stellar mass decreases from 1.2×10^{10} to $9 \times 10^9\,M_\odot$. The burst-to-underlying stellar mass ratio is $\sim$ 5% for $A_V = 0.1 - 0.2$ and is $\sim$ 20% for $A_V = 0.5 - 0.6$. An important result is that the inferred stellar masses are remarkably independent on the final model choice; other parameters such as the ages and masses of each individual component do depend on the metallicity and the extinction used in the models.

LBCGs are very common at redshifts z = 0.4-1.2, but nearly absent in the local Universe. Two main hypotheses have been proposed for their evolution: LBCGs might fade after the starburst to become similar to today's brightest dwarf ellipticals galaxies: $M_B \sim -17$, $B - V \sim 0.9$ (Guzmán et al. 1996). Alternatively, Hammer, Gruel, Thuan et al. (2001) claim that their BCGs might be the progenitors of the central, bulge components of today's massive galaxies.

To study how LBCGs might evolve after the star-forming process, we create a artificial galaxy with two stellar components: An underlying population: $\tau = 1\,\mathrm{Gyr}$, $M_\star = 10^{10}\,M_\odot$, and age $= 2\,\mathrm{Gyr}$, and a young burst of mass $10^9\,M_\odot$. Then its characteristics are analized at different times after the star formation event. The mass-to-light ratio of the model galaxy is $\sim$ 0.2 in the B and K bands. If a similar galaxy evolves passively from $z = 0.6$ to $z = 0$ ($\sim$ 5.7 Gyr with the standard cosmology) it fades $\sim$ 3.3 mag in B and $\sim$ 1.6 mag in K. Hovewer, the stellar mass remais almost unchanged, increasing the mass-to-light ratios to 3.5 and 1.0 in B and K bands. Also the $B - V$ color suffers an important reddening from 0.1 to 0.8 mags. The evolved products are similar to the more luminous dwarf elliptical galaxies of the local Universe.

REFERENCES

Bruzual G., & Charlot S. 2003, MNRAS, 344, 1000

Groth E.J., Kristian J.A., Lynds R., et al. 1994, BAAS, 185, 5309

Guzmán R., Gallego J., Koo D.C., et al. 1997, ApJ, 489, 559

Guzmán R., Koo D.C., Faber S.M. & Illingworth G.D. 1996, ApJ, 460, L5

Hammer F., Gruel N., Thuan T.X., et al. 2001, ApJ, 550, 570

Kobulnicky H.A. & Zaritsky D. 1999, ApJ, 511, 118