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Hα IMAGING AND PHOTOMETRY OF BLUE COMPACT GALAXIES WITH 6-M TELESCOPE

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ABSTRACT

We perfom a large project for complex study of Blue Compact Galaxies (BCGs) with strong star formation, which includes optical spectroscopy, BVR CCD photometry and HI 21 cm radio survey. The most interesting galaxies are studied also with HST and VLA. In the frame of this project we began the study of Hα morphology of BCGs with 6-m telescope. We present and discuss here the results for the first 6 galaxies. We found the noticeable variety of forms for Hα morphology comparing to broad band images: from very compact HII region in very center of stellar body (Mark 996, possible dwarf post-merger, old galaxy experiencing strong star formation burst), to very extended gas emission encompassing the whole area traced by stars (SBS 0335-052, the most probable young galaxy in formation).

Key Words : galaxies formation – star burst – photometry

I. INTRODUCTION

Phenomenologicaly Blue Compact Galaxies (or HII-galaxies) are :

- Dwarf starbursting galaxies
- Least chemically evolved, gas-rich galaxies, with nearly primordial helium abundances
- Supergiant HII regions with strong emission lines.

There are some important problems, connected with BCG studies:

- Chemical and dynamical evolution dwarf galaxies and interrelations of different types of dwarfs: dIrr, dE, LSBD and BCDG
- Mechanisms of star-formation bursts, role of environment and processes in dwarf galaxies
- Physics of hot state in dwarfs: pronounced effects of accumulated energy release by SN and massive stars.

H_α imaging is a powerful tool to study star-formation in galaxies. But up to now only very limited data is accumulated on H_α images of Blue Compact Galaxies. To study in more details SF phenomenon in BCGs, we undertake H_α survey of statistical sample of BCGs in order to get:

- the current SFR;
- to estimate the total number of young O stars;
- to study the range of morphology of H_α emission

and then to confront these properties with global parameters of studied galaxies, like absolute magnitude, total HI mass and total size, in order to check different models of this very common galactic phenomenon.

Here we present the results on some small subsample of BCGs from early autumn sky. These observations were carried out as testing program for new kit of narrow H_α filters for different ranges of radial velocity up to 10000 kms^{-1}. Due to observational time limitations we selected BCGs which could surve as representatives of their rather wide parametric space.

For D it is based on $H = 75\, km/sec\, Mpc$

II. OBSERVATIONS AND DATA REDUCTION

Observations were carried out in the prime focus of 6-m telescope of Zelenchuk observatory, Russia in August 1994. For each filter 2 exposures were obtained with 600 sec each. Preliminary processing of the raw images including all necessary corrections was done using MIDAS routins.

Net H_α and R-band images were computed by subtraction of normalized broad-band image from H_α narrow-band, and then subtracting H_α line flux from broad R-band flux.

III. CONCLUSIONS

1. H_α emission in studied Blue Compact Galaxies is generated in giant HII regions with the size of $0.3 \div 1$ kpc predominantly in their central parts. Their number can vary from one to few.
2. We estimate current SFR (Star Formation Rate) for these galaxies, which is high and typical for

Table 1. BCGs for Hα Imaging

IAU-type name	App.mag. m_R	size "	redshift z	Abs.mag. M_B	distance D (Mpc)	Other name
0125 – 065	14.30	15*13	0.0052	-16.68	20.8	Mrn 996
1535 + 554	15.05	10	0.0028	-15.42	11.2	Mrn 487
1637 + 644	17.07		0.0210	-17.9	84.0	HS
1851 + 693	17.57		0.0250	-17.7	100.0	HS
2246 + 315	17.50	10*8	0.0133	-18.10	53.2	Mrn 921
2329 + 286	14.44	9	0.0185	-18.85	74.0	Mrn 930

Table 2. Star Formation Rates, Gas Depletion Time and Number of O Stars

Name	Flux $F^{\star}_{H_\alpha}$	SFR_{H_α}, $M_\odot/year$	SRF_{IRAS}, $M_\odot/year$	M_{HI} $10^8 M_\odot$	τ_R $10^8 year$	N_{O7} $*10^3$
0125-065	2776	0.15	0.30	1.15	7.7	7.4
1535+554	2240	0.04	0.07	0.58	14.5	2.1
HS 1637+644	605	0.54		11.0	5.5	32
HS 1851+693	1627	2.07		7.5	4.0	120
2246+315	451	0.16::	1.80	14.45	3::	9.6
2329+286	7810	5.43	11.48	26.90	5.0	320

* Fluxes in the units of $10^{-16}\frac{erg}{cm^2\,sec}$

BCGs: ($SFR = 0.04 \div 5.4 M_\odot$/yr). This SFR can not be held at current level during the cosmological time. The reservoir of neutral gas would be run out in these BCGs only in $(3 \div 14) * 10^8$ years.

3. The estimates of the number of young O7 stars in giant HII regions of studied BCGs range from 2000 to 100000. This is also the evidence for high current star formation rate.

4. H_α emission seems to be the most reliable indicator of current SFR for due to lower dust abundance in BCGs can lead to underestimate of SFR from far-infrared luminosity.

5. The derived surface brightness distributions of these BCGs in R-band and H_α line for radial distances $r \geq 2.5''$ are well approximated by models with one or two exponentional disks. Average on 6 BCGs scale length is ~0.47 kpc for R-band continuum and ~0.3 for H_α emission.

6. Even this small subsample of BCGs shows a large variety of the stellar component morphologies ranging from irregular (like in Mkn 930, through disk-like (as in HS 1637+644) to elliptical (as in Mkn 996).

7. H_α emission morphology can differ significantly from that of broad band continuum. For example, in Mkn 996 and HS 1637+644 $_\alpha$ emission comes from much more compact region in the center of stellar body. In other objects, like Mkn 930, the appearance in the line and continuum is rather similar, both in bright spots and in lower brightness extended envelope.

8. The diversity in morphology from 2 previous conclusions can reflect the variety of circumstances and burst phases, in which we observe intense star formation in BCGs.