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Hα AND [OIII] EMISSION LINE MAPS OF MRK 1318 AND TOL 1358-328. CHARACTERISING THE STAR FORMATION IN HII GALAXIES

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RESUMEN

Usando imágenes en los filtros Hα y [OIII] λ5007 tomadas con el telescopio SOAR de 4.1 m hemos creado un catálogo de regiones HII en las galaxias HII Tol 1358-328 y Mrk 1318. Este catálogo es el primer paso de un trabajo que pretende caracterizar la formación estelar y el impacto que tiene en el medio interestelar (MIE) que lo rodea en galaxias HII extremadamente jóvenes.

ABSTRACT

Using Hα and [OIII] λ5007 images taken with the 4.1 m SOAR telescope we have created a catalogue of HII regions in the HII galaxies Tol 1358-328 and Mrk 1318. This catalogue is the first step of a work that intends to characterize star formation and its impact in the surrounding interstellar medium (ISM) in extremely young HII galaxies.

Key Words: H II regions — galaxies: irregular — galaxies: star clusters

1. INTRODUCTION

HII galaxies are emission-line galaxies undergoing a strong burst of star formation (Terlevich et al. 1991, hereafter Te91). They present varied morphologies ranging from dwarf to spirals and present a blobby internal structure with a non uniform distribution of star-forming knots (Te91; Telles 2003).

Rosa-Gonzalez et al. (2007) analysed the thermal emission at 1.4, 4.9 and 8.3 GHz of 31 HII galaxies from the HII galaxies catalogue of Te91. They found that 50% of the galaxies in the sample present a thermal slope and some even present free-free absorption at long wavelengths. This result led them to conclude that this "lack" of synchrotron emission can be explained as if the photoionizing stellar systems are young enough that their most massive stars have not exploded as supernovae yet, being extremely young stellar systems with ages less than 3 Myrs.

Our sample consists of 6 HII galaxies (Table 1) from the work of Rosa-Gonzalez et al. (2007) and Te91.

TABLE 1

SAMPLE OF SELECTED GALAXIES

Galaxy	R.A. (2000.0) h:m:s	Dec (2000.0) d:m:s
Tol 0957-278	09:59:21.1	−28:08:00
Mrk 1318	12:19:09.9	+03:51:23
Mrk 52	12:25:42.8	+00:34:21
UM 533	12:59:48.1	+02:02:57
Tol 1303-281	13:05:46.7	−28:25:20
Tol 1358-328	14:01:21.5	−33:03:50

2. OBSERVATIONS, DATA REDUCTION AND CALIBRATION

The images of the galaxies for this project were obtained with SOAR 4.1 m telescope in Cerro Pachon Chile, on May and July of 2008. The detector used was the SOAR Imager (SOI), a two CCDs array of 1024×4096 pixels each, covering a $5.5' \times 5.5'$ field of view with a pixel scale of 0.15 arcsec/pixel in the 2×2 binned mode. Since our objective is to identify star forming knots and characterise the ISM that surrounds them, the filters used were Hα (CTIO 660075-4), [OIII] λ5007 (CTIO 5019) and y Strömgren.

The usual reduction steps were applied to the data: bias subtraction, flat-fielding, cosmic-ray elimination and sky subtraction. To flux calibrate the images we used two spectro-photometric standard stars and the method proposed by Jacoby et al. (1987). The y Strömgren image, scaled so that the field stars average flux was equal to that of the line+continuum image, was taken as contin-

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TABLE 2

HII REGIONS PARAMETERS

HII regions	Radius[1] (pc)	Log(Lum)[2] (erg s^{-1})
Orion	5	37
30 Dor	200	40.2
Mrk 1318	60–230	∼39
Tol 1358-328	30–392	35–40

[1]The radius was computed assuming a distance of 20.9 Mpc to Mrk 1318 and of 16.7 Mpc to Tol 1358-328.

[2]The luminosity was corrected for internal extinction using the Balmer decrement from Te91.

uum. This frame was subtracted then from the line+continuum image providing the continuum-free line frame.

3. RESULTS AND FUTURE WORK

A catalogue of HII regions candidates was created using the Hα images and the automatic detection code SExtractor (Bertin & Arnouts 1996). To avoid confusing image noise with real structure, for a candidate structure to be accounted as an HII region the area covered by it has to be larger than a minimum area, $A_{HII} = \pi \times (FWHM_\star/2)^2$, defined by the image seeing or image mean stellar full width at half maximum (FWHM$_\star$).

We were able to identify, for the first time in these galaxies, 7 and 142 perfectly delimited HII regions in Mrk 1318 (Figure 1) and Tol 1358-328 (Figure 2). In Table 2 we compare the Hα radius and luminosity values of Orion and 30 Dor (Kennicutt 1991) with those of the HII regions found in Mrk 1318 and Tol 1358-328. It can be seen that the radii found have characteristic values of these type of objects, and that the Hα luminosity of some of the HII regions is similar to that of 30 Dor nebula.

The next step is to identify the HII regions in the [OIII] images and estimate their ages using Hα equivalent width in combination with broad band photometry. This will allow us to understand the impact that the young stellar population has on the ISM as well as the star formation history of the selected HII galaxies.

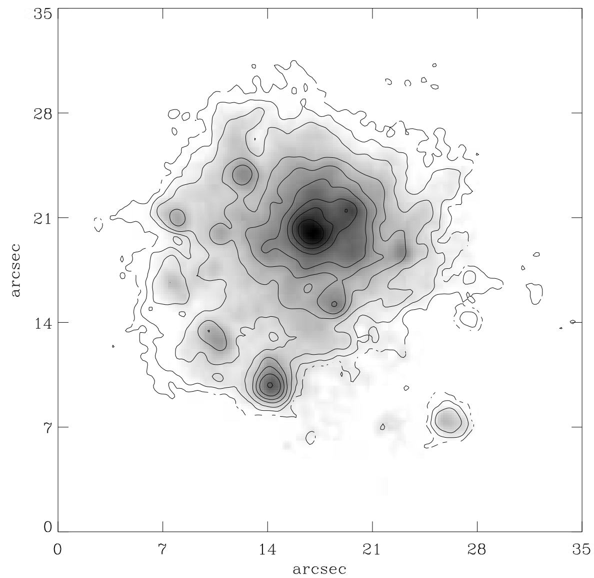

Fig. 1. Mrk 1318 [OIII]λ5007 map with Hα contours overploted.

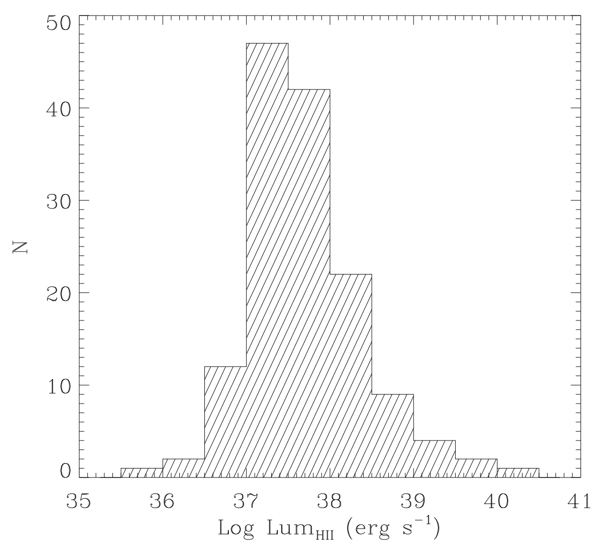

Fig. 2. Histogram of HII regions Hα luminosity in Tol 1358-328.

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