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THE IMPACT OF STARBURSTS IN THE HALOS OF BLUE COMPACT DWARF GALAXIES (A PROPOSAL[1] FOR OSIRIS)

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RESUMEN

Proponemos obtener imágenes profundas en las líneas de emisión más relevantes para una muestra de galaxias azules compactas, en el telescopio GTC, con OSIRIS en el modo de filtros sintonizables. A partir de los mapas en las diferentes líneas de emisión vamos a estimar las propiedades físicas del gas ionizado difuso, así como el mecanismo reponsable de su ionización.

ABSTRACT

We propose to perform deep narrow band imaging in several emission lines of interest for a sample of blue compact dwarf galaxies at the GTC, with the OSIRIS facility in tunable filter mode. From the emission line maps, we will determine the physical properties of the diffuse ionized gas and disentangle the nature of the ionizing source.

Key Words: **GALAXIES : DWARF — GALAXIES : HALOS — GALAXIES : STARBURST**

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1. INTRODUCTION

The main aim of this proposal is to understand the interplay between star formation and the interstellar medium by studying the diffuse ionized gas (DIG) in a sample of blue compact dwarf galaxies (BCDs). The DIG is a warm (≈7000 K), diffuse ($n_e \approx 0.1$ cm^{-3}) and often filamentary component of the interstellar medium that has been reported in the literature for different galaxy types. In the Milky Way, the DIG accounts for almost 30% of the total H I column and fills at least 20% of the volume of the galaxy (Reynolds 1991). An increasingly large number of emission lines have been measured on the DIG at the Milky Way (see references in Reynolds et al. 2001).

In edge-on spirals, halo emission and filaments have been detected at distances up to ≈5–10 kpc from the plane (Hoopes et al. 1999; Rand 2000; Tüllmann & Dettmar 2000). The DIG contributes to ≈ 40–50% to the total Hα luminosity of spirals (Hoopes et al. 1999; Zurita et al. 2000).

Concerning late-type galaxies, large filamentary structures lying away from classical H II regions were reported for a sample of Magellanic irregular galaxies (Hunter & Gallagher 1990). They were found to show surface brightnesses higher than the typical diffuse Galactic emission. González-Delgado et al. (1994) reported a faint extended broad emission line region detected in Hα and [O III] in the galaxies NGC 2363. This was later interpreted as the result of the smooth acceleration of a shell of interstellar material (Tenorio-Tagle et al. 1997). Signatures of superbubbles or superwind activity were reported from Hα imaging of a sample of amorphous galaxies (Marlowe et al. 1997). From 3D Fabry–Perot spectroscopy, Muñoz-Tuñón et al. (1998) estimated that 54% of the total luminosity of giant star forming regions is lost to the DIG, which amounts to 30% of the total Hα luminosity in NGC 4449. From long slit spectroscopy, Martin (1997) found that no discontinuity between the spectral properties of the H II regions and those of the DIG.

To date, several mechanisms have been proposed in the literature as the main sources of UV photons to ionize the interstellar medium: field O and B stars (Hoopes & Walterbos 2000; Hoopes et al. 2000), UV photons escaping from H II regions (Beckman et al. 2000; Iglesias-Páramo & Muñoz-Tuñón 2001), shock

[1] In collaboration with E. Pérez, J. M. Vílchez, L. M. Cairós, G. Tenorio-Tagle, and S. Silich.

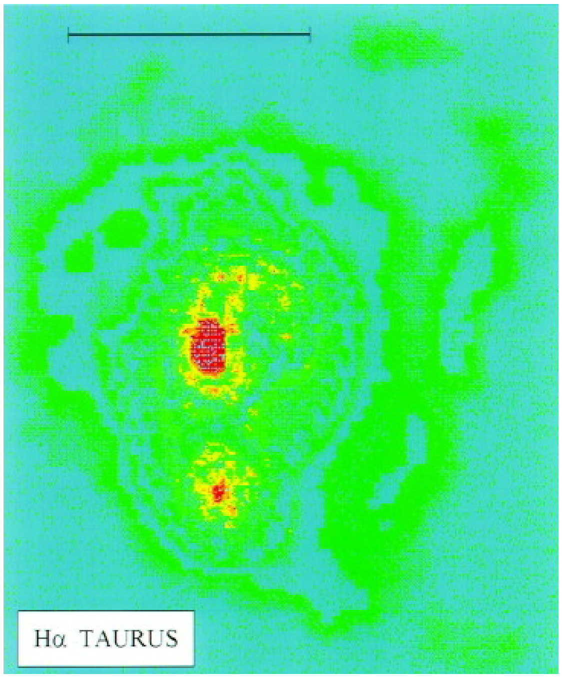

Fig. 1. Hα imaging of the BCD galaxy I Zw 18 taken with TAURUS at the 4.2 m William Herschel Telescope. The extended diffuse ionized halo is apparent.

ionization (Martin 1997), and dissipation of turbulence (Minter & Spangler 1997). All these mechanisms are able to produce enough photons to explain the observed emission line fluxes in the interstellar medium, but none of them is able fully to explain the line ratios observed for the interstellar DIG, thus a combination of more than one is claimed by most authors.

2. THE PROPOSAL

We propose to perform very deep imaging of a sample of BCDs with well known properties (Cairós et al. 2001) selected on the basis of a strong star formation activity. The required instrument for this project is OSIRIS[2], in the Tunable Filter mode on the GTC. We select BCDs because they normally host very few star formation bursts, thus an understanding of the physical processes in these kinds of objects should be more easily acquired than in more complicated ones. BCDs are also are very compact (about 5 arcmin diameter at typical optical wavelengths for nearby galaxies), which is ideal for the OSIRIS field. In addition, extended haloes of diffuse ionized gas have been reported for some of them (see Figure 1).

The emission lines of interest for this proposal are [O II] λ3727 Å, Hβ, [O III] λ5007 Å, [O I] λ6300 Å, Hα, and [S II] $\lambda\lambda$6717,6731 Å. The expected limiting surface brightness will be much lower than for previous studies of the DIG in external galaxies: at Hα we expect to reach 10^{-17} erg sec^{-1} cm^{-2} with SNR ≈ 1 in 1800 s. As a result of the observations, we will obtain deep emission line maps of our sample galaxies, from which we expect to estimate the physical properties of the DIG (morphology, extinction, density, metallicity, and excitation) and to shed light on the nature and ionization source of the DIG. We will make use of hydrodynamical and photoionization models to compare the observational results with the theoretical predictions.

[2]Optical System for Imaging and Low-Resolution Integrated Spectroscopy.

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