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OSIRIS Hα IMAGING OF THE NGC 2770 SUPERNOVA FACTORY AND ITS SATELLITE NGC 2770B

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In the last 12 years NGC 2770 hosted 2 standard supernovae (SNe) and one X-ray transient event (SN2008D) similar to a Gamma-Ray Burst (GRB). Given the close (27 Mpc) distance of NGC 2770, we could resolve with the OSIRIS tunable filter (TF) the 3 explosion sites in Hα. We also show Hα data of its satellite galaxy NGC 2770B, one of the least metallic galaxies in the local Universe.

It is well known that long-duration GRBs are associated to Ic-type hypernovae (Hjorth et al. 2003) occurring at high redshift (Jakobsson et al. 2006), where most of their host galaxies can not be resolved from the ground. Thus, the lack of GRBs in the local universe makes it difficult to study their explosion sites. Hence the physical-chemical conditions that favour the occurrence of a long-duration GRB are not well known yet. The main goal of this study is to try to understand why some massive stars explode as long-duration GRBs whereas others do it as standard SNe. NGC 2770 is an excellent target to answer this question. It hosted 2 standard SNe (SN 1999eh, SN 2007uy) and a very peculiar X-ray transient event (SN 2008D). SN 2008D attracted special attention due to its similarities to long-duration GRBs. In addition, NGC 2770 has 3′ away, a satellite galaxy (NGC 2770B) which shows one of the lowest metallicites seen in the local Universe (Thöne et al. 2009). Gorosabel et al. (2010, 2011) determined the linear optical polarization in the line of sight of SN 2007uy and SN 2008D, and thus the Galactic magnetic field.

We observed both targets using the OSIRIS guaranteed time. Given the angular proximity of the 2 galaxies we could fit them in the OSIRIS field of view. NGC 2770 was placed in chip #1 and NGC 2770B in chip #2. OSIRIS was rotated so the inter-chip gap was parallel to the NGC 2770B major axis. The GTC pointing was chosen so both galaxies were are at the same distance from the optical axis. This secured a minimum wavelength drift in NGC 2770, and the observing wavelength for both objects. We took data in 5 wavelengths, 3 scanning Hα and 2 additional wavelengths for the continuum. The observation of each wavelength was composed of 3 dithered exposures. All observations were done with a filter FWHM of 15 Å. The 3 wavelengths scanning the line were separated by ±10 Å around Hα (±2/3 of the filter FWHM). The continuum was sampled at ∼±70 Å around Hα. The line (continuum) images had an exposure time of 80 s (100 s).

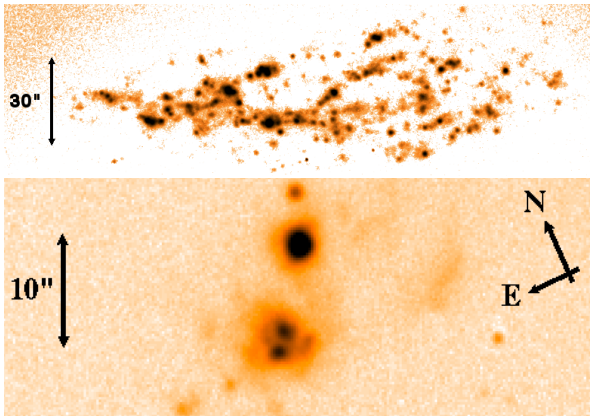

Fig. 1. The NGC 2770 galaxy (up) and its satellite galaxy NGC 2770B (bottom) imaged in Hα by OSIRIS.

As seen in Figure 1, NGC 2770 and NGC 2770B show a clumpy morphology in Hα. In the SN 2008D (SN 2007uy) site the Hα emission does (not) seem to follow the magnetic field direction. We plan to observe NGC 2770B in [SII] to map the shocked material around the 3 explosion sites. NGC 2770B is composed by two main blobs separated by ∼10″ (1.3 Kpc). The one at south-east contains two smaller knots, separated by ∼2″ (260 pc). Our study would be highly benefited by the blue OSIRIS TF, which would map Hβ, [OII] and [OIII].

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