Shells and shocks in the Galactic star-forming region RCW 49

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RCW 49, also known as G284.4-0.3 (Goss & Shaver 1970), is a very bright, complex and extended HII region (~ 40' × 50'), largely imaged at radio continuum and recombination lines. Recent studies using Spitzer data pointed to the super star cluster Westerlund 2 as RCW 49's ionizing agent and confirmed that star formation is taking place there (Churchwell *et al.* 2004). Using Chandra data, Tsujimoto *et al.* (2007) cataloged hundreds of cluster members, mostly young stellar object (YSO) candidates and early-type stars.

Whiteoak & Uchida (1997) obtained radio continuum maps with the Compact Array at 1.4 and 2.4 GHz and the Molonglo Observatory Synthesis Telescope (MOST) at 843 MHz. They identified two shell-like structures, shown in Figure 1: one to the south around the bright star WR 20b (in purple), and one incomplete shell in the north surrounding Westerlund 2 (in magenta), with a possible 'blister' toward the west.

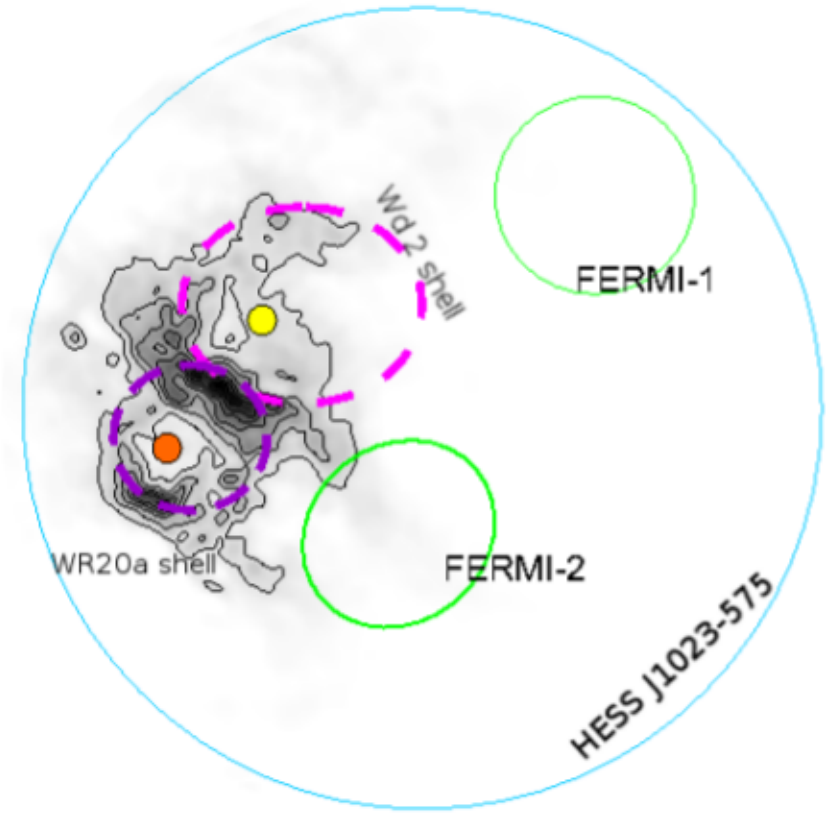

Figure 1: The Galactic star-forming region RCW 49 at 843 MHz (greyscale and contours). The yellow and orange circles mark the core of the cluster Westerlund 2 and the position of the star WR 20b, respectively, while the ellipses in dashed lines represent the shells proposed by Whiteoak & Uchida (1997). Green and cyan rings represent the location of FERMI and HESS high-energy sources.

A couple of open questions

At least three high-energy objects were recently detected superimposed on RCW 49: the bright, extended TeV source HESS J1023-575, and two GeV Fermi sources (2FGL J1022.7-5741 or Fermi-1, 2FGL J1023.5-5749c or Fermi-2). Despite 50 hours of dedicated monitoring with the High Energy Stereoscopic System (HESS), and a number of studies focused on determining the nature of the HESS object, no conclusive result was achieved. Figure 1 displays the main objects present in the field.

The distance to the ionized region and the super cluster remains highly controversial. Studies of the stars at different evolutionary stages, and of the gas from various transitions/frequency bands, yield values from 2.5 to 8 kpc (see, for instance, Vargas Álvarez *et al.* 2013 and references therein).

Observing with the ATCA CABB system

We carried out Compact Array observations toward RCW 49 in Feb 2012 using the Compact Array Broadband Backend (Wilson *et al.* 2011) in two array configurations, 6A and 750D, 12 h each. Data at 5.5 GHz and 9.0 GHz were obtained simultaneously, with a bandwidth of 2 GHz each. The band selection allowed us to attain very-high-resolution images (relative to the 1.4 and 2.4 GHz ones) at frequencies where any potential non-thermal emission could still be detected. With those settings we could probe structures of 1–100 arcseconds in extent. The results are presented in a paper by Benaglia, Koribalski, Peri, Marti, Sanchez-Sutil, Dougherty & Noriega-Crespo (2013, A&A, 559, A31).

The observations were centered on RCW 49 and covered an area of 30 square arcminutes. The observing strategy consisted of building a mosaic with 41 pointings, ensuring Nyquist sampling at the higher frequency band. The integration time for each pointing was approximately 13 minutes.

Data editing, calibration, and image reconstruction were performed with the multichannel image reconstruction, image analysis and display (MIRIAD) routines (Sault *et al.* 1995). We had to deal with a very extended radio source, of high dynamic range and substructure sizes at various scales, and data along 2-GHz bandwidths. We tried various approaches for constructing the images. The maximum-entropy deconvolution methods proved to be the best for both minimizing side lobes and dealing with different levels of radio luminosity from the various pointings.