A new radio look of the pulsar wind nebula 3C 58

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BACKGROUND

3C58 (G130.7+3.1), is without doubt an archetypical example of a pulsar wind nebula. It is powered by the pulsar PSR J0205+6449, which provides with $2.7 \times 10^{37}$ erg s$^{-1}$ to the PWN, a factor almost 20 times smaller than the Crab's pulsar. The kinematic distance to 3C58 is 2 kpc, derived from HI data (Kothes 2013, AA, 560).

3C58 IN TOTAL INTENSITY

S-band (2-4 GHz)

C-band (4-8 GHz)

ROTATION MEASURE AND THE MAGNETIC FIELD DISTRIBUTION

The new wideband JVLA observations allow for accurate rotation measures across the source. This information was used to determine the magnetic field (B) configuration in the nebula. The S-band(C-band) data consist of 16(31) spectral windows each 128 MHz wide with 64 frequency channels. Using the calibrated data, we formed a series of Stokes Q and U images for each frequency band separately. The visibility data were tapered in the imaging process. The output products, concatenated along the spectral axis, were then fitted using the CASA rmap task to determine the RM distribution and the intrinsic polarization position angle in 3C58 (Leahy 1986, AA, 150). The algorithm that this task uses resolves the unknown number of half rotations of the polarization angle between the source and observer.

THE NEW DATA

We present here new full-synthesis imaging of intensity and polarization observations of 3C58 made on 2017 June with the wide-band S (2-4 GHz) and C (4-8 GHz) receivers of the Karl G. Jansky Very Large Array (JVLA) in its C and D configurations. The observations in the S frequency band consisted in a single pointing while in the C band a mosaicking mode by combining 10 different pointings was used to cover the full extension of 3C58. The Common Astronomy Software Applications (CASA) package was used for all of the reduction procedures. A wide-field imaging technique combined with multi-scale and multi-frequency deconvolution algorithms were adopted to construct Stokes I, Q, and U images over the full observed bandwidths.

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FUTURE WORK

• Investigate depolarizing mechanisms operating in the 2-8 GHz range.
• Extent our analysis using the technique of RM synthesis to measure the Faraday spectrum separating contributions from multiple interfering components.