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THE ENVIRONS OF THE MASSIVE RUNAWAY STAR BD+43° 3654

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The very massive runaway star BD+43° 3654 (O4 If) seems to be related with a bow shock detected by the MSX mission, that would be the result of the interaction of the strong stellar wind with the ambient matter. Shock-accelerated electrons will cool through synchrotron radiation producing a non-thermal radio source, yet never detected in such scenario. While new Very Large Array observations are carried out, we have examined archive data and present here the findings.

BD+43° 3654 (J2000: $\alpha = 20°33'36.''0768$, $\delta = 43°59'07.''401$) was identified as a runaway star by Van Buren & McCray (1988), who also suggested the presence of a bow shock on IRAS images. Recently, Comerón & Pasquali (2007) concluded that the star would be coming from the Cygnus OB2 association, fixing its distance ($d_* \sim 1.45$ kpc). The star would be located between the Sagittarius-Carina and Perseus spiral amrs (see Russeil 2003).

Observations. Continuum data at 5GHz (Griffith et al. 1991) showed no coincidences with our source. VLA images at 1.4 GHz (Condon et al. 1998) revealed emission matching the infrared bowshock (see Figure 1). In order to study the emission regime via spectral indices we have observed the field at 1.4 GHz (at high resolution) and 5 GHz with the VLA. The observations are now at the reduction stage.

The CGPS survey (www.ras.ucalgary.ca/CGPS) made available a large HI 21 cm line database that includes the region of BD+43° 3654 allowing to determine the neutral gas distribution and kinematics.

Analysis and results. The circular galactic rotation curve assigns angular and linear velocities to galactocentric distances. The redshifts of spectral lines can be expressed in gas velocities and help us to study its distance. We have searched for HI structures that can be related to the bow shock or the star, and for minima in the HI distribution that would be produced if ambient gas is being swept up.

The CGPS observations are organized in 5° × 5° mosaics as (l,b,v) data cubes of 1.3 km s^{-1} velocity resolution. We looked for gas located at the distance of BD+43° 3654 and focused in velocities at (−15,15) km s^{-1}. For each channel we built brightness-temperature countour maps.

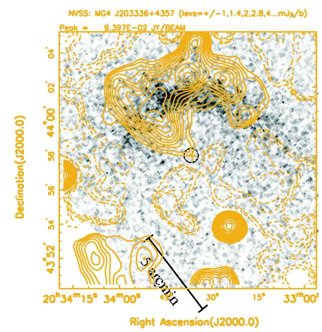

Fig. 1. Superposition of infrared and radio images.

After the velocity of each channel was identified, the rotation curve of Fich et al. (1989) was used to build a distance-velocity table. A polynomial fit to those values was used to derive the gas distances. We have also estimated distances from the velocity field of Brand & Blitz (1993).

We proceeded to group the data using different criteria, to search for structures, unsuccessfully: we found no evidence of minima or threads in the HI distribution. Reasons for this result can be the following: (1) the target star is at a region of the sky where HI structures and their analysis are all but simple; (2) the star is on the galactic plane, as most of the HI; (3) the line of sight probes many spiral arms in its path; (4) the galactic rotation at that longitude provides two distances for the same gas velocity; (5) much gas located at a very wide range of distances (1 to 4 kpc) shares similar velocities spread in a short range: a few km per s; (6) there is gas with forbidden velocities. All these effects give rise to large inaccuracies in distance determinations.

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