Disrupted HI Environment around M82

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We obtained 21cm HI aperture synthesis maps of the "exploding galaxy (Lynds and Sandage 1963)" M82 using the D-configuration of the VLA in order to trace the distribution and kinematics of the atomic gas in and around M82 with a high sensitivity. A field centered at M82 and four adjacent fields were observed and mosaiced together with a spectral resolution of 48.8 kHz (10.3 km s^{-1}) and $62'' \times 68''$ beam (FWHM). The detection sensitivity corresponds to 2.7×10^{19} atoms cm^{-2}. In addition, we also obtained a set of large field ($26' \times 26'$) deep exposure Standard (Harris) R-band optical images using the Tek 2048 CCD on No.1 0.9-m telescope at Kitt Peak, Arizona, to compare the observed HI features with optical images.

Gas Distribution. A total of $3.3 \times 10^8 M_\odot$ HI gas is found directly associated with M82 while additional $1.6 \times 10^8 M_\odot$ of HI gas is also found in a large HI complex $25'$ southeast of M82 ("concentration II" of Rots and Shane 1975), connecting to M82 by a long tail of emission. Nearly all of HI detected is confined within highly organized streamers, loops, or filaments. It is strongly suspected that a recent interaction with a companion is largely responsible for the formation of these structures.

Kinematics. The general gradient of the observed velocity field is along the minor axis, and little trace of stellar disk-like rotation is found beyond the nuclear region. Cottrell (1977) identified such a gradient as an orbital motion of tidally captured HI cloud along the minor axis. Since the HI distribution we find around M82 is dominated by tidal features rather than orbiting ring-like distribution, we propose an alternate explanation for the observed kinematics as tidally induced disruption of the outer HI disk of M82.

Comparison with optical images. No diffuse optical emission corresponding to large scale HI tails or filaments is found. The stellar disk of M82 shows only a minor sign of disruption – a flaring of the outer disk. If the observed HI features around M82 have their origin within M82, this serves as one of the *first clear examples of how stars respond differently from gas in a tidal disruption of a galaxy.* A very good correspondence between the dust lanes in the disk and the HI streamers is found.

References

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