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R.T. Schilizzi, S. Vogel, F. Paresce and M. Elvis

The Gas Dynamics in the Centre of the Starburst M82

Karen Wills

Dept. of Physics and Astronomy, The University of Sheffield, Sheffield, S3 7RH, U.K.

Alan Pedlar, Tom Muxlow

Jodrell Bank Observatory, Macclesfield, Cheshire, SK11 9DL, U.K.

Mousumi Das

Raman Research Institute, Sadashivanagar, Bangalore 560 080, India

Abstract.
VLA A-array 21cm atomic hydrogen (HI) absorption observed against the central region of the starburst galaxy M82 and MERLIN HI absorption measurements which show HI absorption against 26 of the supernova remnants are discussed. These observations have been compared with the molecular (CO) and ionised ([NeII]) gas distributions and used to constrain the dynamics and structure of the ionised, neutral and molecular gas in this starburst.

1. Observations

We report on H1 absorption observations of M82 using MERLIN and the VLA. A full description of the MERLIN observations are in Wills et al. (1998) and of the VLA observations in Wills et al. (2000). The MERLIN observations have an angular resolution of $\sim$ 0.4 arcsec and the VLA observations $\sim$ 1.3 arcsec. Continuum images were formed from line free channels and subtracted from the datacubes. After de-convolution the data were used to construct datacubes of the optical depth (ie column densities) of the H1 absorption. Figure 1 shows a typical position-velocity plot of H1 optical depth obtained the from the VLA datacube.

2. Results & Discussion

The higher angular resolution MERLIN observations detect H1 absorption mainly against individual supernova remnants, whereas the VLA observations delineate absorption against the diffuse background. Both observations show a gradient in velocity across the central starburst of $\sim$ 7 km s^{-1} arcsec^{-1}, consistent, to first order, with a rotating disk or ring (see Figure 1). However there are clearly significant deviations from circular motion with a prominent 'hole' seen between

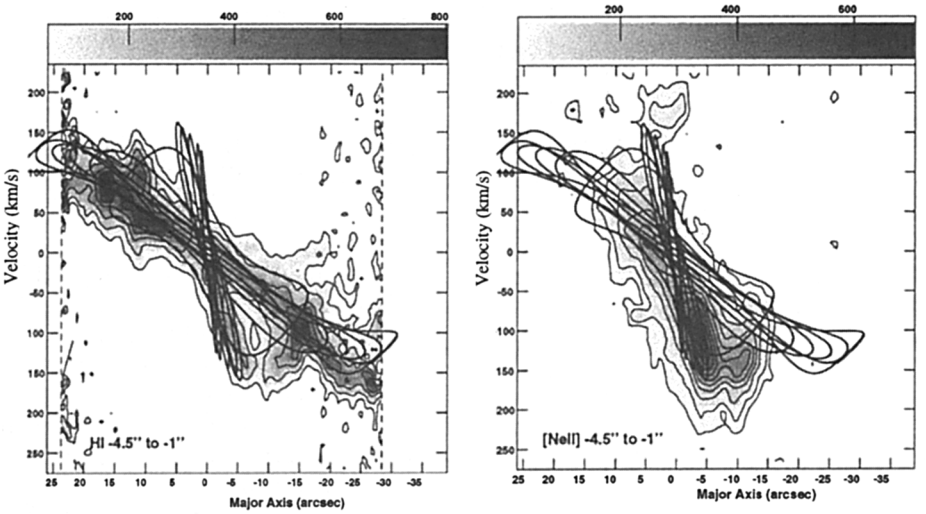

Figure 1. H1 absorption (left) and [NeII] emission (right) p-v plots parallel to the major axis of M82 with x1 and x2 orbits superimposed.

-50 and -150 km/s. A similar feature is also present in CO observations (Weiss et al. 1999). Although this has been interpreted by Weiss et al. as evidence for an expanding superbubble driven by stellar winds, we suggest it could be interpreted as gas flows within a bar potential seen 10 degrees from edge-on. In Wills et al. (2000) we have used a model of the bar potential in M82 to generate a series of stellar orbits. If we assume that gas follows the stellar orbits then it appears that most of the 'superbubble' feature could be formed by a combination of x1 and x2 orbits (Figure 1).

In Figure 1 it can also be seen that the [NeII] ionised gas (Achtermann & Lacy 1995) shows a steeper gradient and smaller linear extent than the neutral gas (H1 and CO) which in the bar model would imply that the ionised gas is largely following the x2 orbits and the neutral gas is largely confined to the outer x1 orbits. The implications of this result are discussed in more detail in Wills et al.(2000).

References

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