Dark Galaxies and Lost Baryons
Proceedings IAU Symposium No. 244, 2007
J. I. Davies & M. J. Disney, eds.

doi:10.1017/S1743921307014287

A 500 kpc HI Tail of the Virgo Pair NGC4532/DDO137 Detected by ALFALFA

Rebecca A. Koopmann[1,2]

[1]Department of Physics and Astronomy, Union College, Schenectady, NY 12308, email: koopmanr@union.edu
[2]National Astronomy and Ionosphere Center†, Space Sciences Building, Cornell University, Ithaca NY 14853

Abstract. HI observations of the Virgo Cluster pair NGC 4532/DDO 137, conducted as part of the Arecibo Legacy Fast ALFA Survey, reveal an HI feature extending ∼500kpc to the southwest. The structure has a total mass of up to 7 x 10^8 $M_\odot$, equivalent to 10% of the pair HI mass. Optical R imaging reveals no counterparts to a level of 26.5 mag arcsec^{-2}. The structure is likely the result of galaxy harassment.

Keywords. galaxies: dwarf, galaxies: evolution, galaxies: formation, galaxies: clusters: Virgo

1. Summary and Results

Cluster environmental interactions (see Boselli & Gavazzi 2006 for a review) can produce tails of gas and stars. The Arecibo Legacy Fast ALFA (ALFALFA) Survey, a sensitive blind survey of the Arecibo sky (Giovanelli *et al.* 2005 and these proceedings), has revealed several HI clouds without optical components (Kent *et al.* 2007 and these proceedings) and a 250 kpc tidal arc emerging from the Sc galaxy NGC 4254 (Haynes *et al.* 2007 and Giovanelli in these proceedings). ALFALFA has recently detected an even larger tidal feature associated with the Virgo Cluster Sm pair NGC 4532/DDO 137. This system was already known to be peculiar: both galaxies have extended HI disks and share a common HI envelope extended over 150 kpc (Hoffman *et al.* 1993, 1999).

ALFALFA observations of the NGC 4532/DDO 137 tail structure are shown in Figure 1. The HI envelope containing and within the immediate vicinity of the pair (bold solid contour) has an HI mass of 6.2 x 10^9 $M_\odot$, consistent with that of Hoffman *et al.* (1999). All of the emission in the tail is blueshifted with respect to the pair HI envelope. The total mass contained within discrete clumps in the tail is 4.0 x 10^8 $M_\odot$. The total mass of the tail, including an upper limit for emission below the ALFALFA limiting column density, is ∼7 x 10^8 $M_\odot$, or ∼10% of the pair HI mass. R imaging of the tail system was carried out at Wise Observatory and the WIYN 0.9-m telescope in May 2007. No optical counterparts for the main HI clumps have been found to a limiting R magnitude of 26.5 mag arcsec^{-2}. Further results are presented in Koopmann *et al.* (2007, in preparation.) VLA syntheis observations of the system are planned.

The observations of NGC 4532/DDO 137 are consistent with several predictions from the simulations of high speed hyperbolic encounters between cluster galaxies by Bekki, Koribalski & Kilborn (2005) and Duc (these proceedings): (a) gas tails that are stretched over several hundred kpc, (b) double tails or tails that span a large spatial area, (c) formation of relatively isolated clumps within the tail, and (d) stellar tails fainter than 30 mag arcsec^{-2}.

† The National Astronomy and Ionosphere Center is operated by Cornell University under a cooperative agreement with the National Science Foundation.

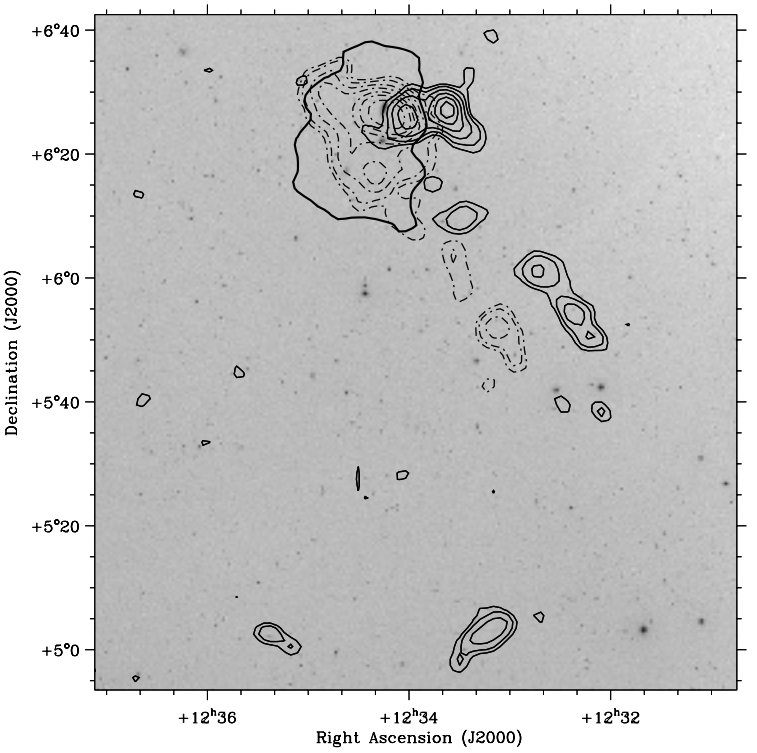

Figure 1. ALFALFA HI flux contours superposed on a DSS2 Blue Image. The single bold contour at 0.4 Jy beam^{-1} km s^{-1}, integrated over 1951 - 2139 km s^{-1}, encompasses the approximate area of the HI envelope detected by Hoffman *et al.*(1993). Solid contours show tail emission integrated over 1784 - 1836 km s^{-1}, with contours at 0.12, 0.17, 0.25, 0.35, 0.45, 0.55 Jy beam^{-1} km s^{-1}. Dot-dashed contours show tail emission integrated over 1868 and 1930 km^{-1}, with contours at 0.17, 0.24, 0.4, 0.6, 0.9, 1.2, and 1.7 Jy beam^{-1} km s^{-1}.

The discovery of an extended tail with discrete clumps so distant from the parent galaxy suggests a tidal explanation for at least some isolated HI clouds with no optical counterparts, such as those recently discovered in the Virgo Cluster (Kent *et al.* 2007 and these proceedings).

Acknowledgements

The author is grateful for partial support from NAIC, travel support from the Mellon Foundation, and for the hospitality of the Cornell University Astronomy Department during a sabbatic visit.

References

Bekki, K., Koribalski, B. S., & Kilborn, V. A. 2005, *MNRAS* 363, L21
Boselli,A. & Gavazzi, G. 2006, *PASP*, 118, 517
Giovanelli *et al.* 2005a, *AJ*, 130, 2598
Haynes, Giovanelli, & Kent 2007 *ApJ*, 665, 19
Hoffman, G. L. *et al.* 1993, *AJ*, 106, 39
Hoffman, G. L. *et al.* 1999, *AJ*, 117, 811
Kent *et al.* 2007 *ApJ*, 665, 15