

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

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**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  $\sim 500$  kpc to the southwest. The structure has a total mass of up to  $7 \times 10^8 M_{\odot}$ , equivalent to 10% of the pair HI mass. Optical R imaging reveals no counterparts to a level of 26.5 mag arcsec<sup>-2</sup>. The structure is likely the result of galaxy harassment.

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

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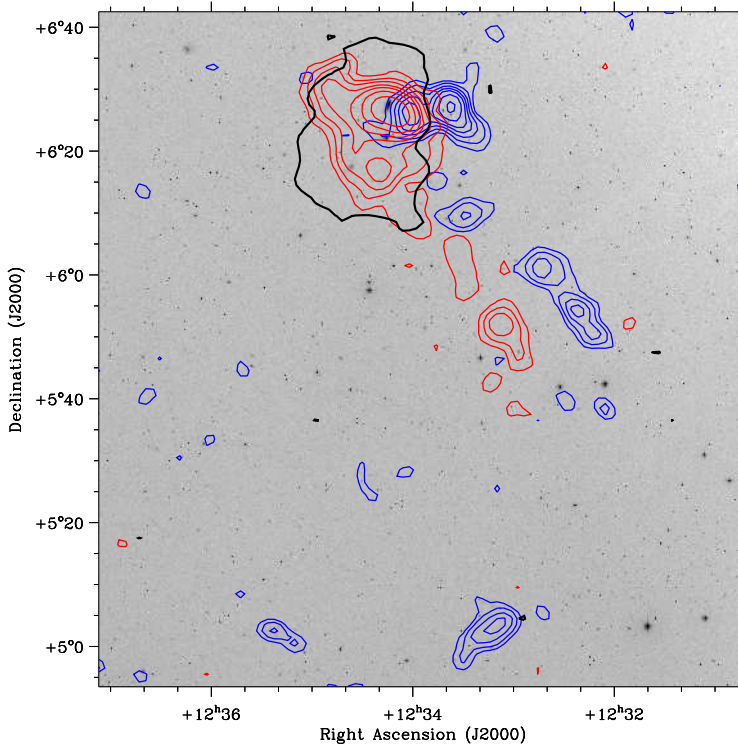
## 1. Summary and Results

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 (black contour) has an HI mass of  $6.2 \times 10^9 M_{\odot}$ , 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  $4.0 \times 10^8 M_{\odot}$ . The total mass of the tail, including an upper limit for emission below the ALFALFA limiting column density, is  $\sim 7 \times 10^8 M_{\odot}$ , or  $\sim 10\%$  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<sup>-2</sup>. Further results are presented in Koopmann *et al.* (2007, in preparation). VLA synthesis 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<sup>-2</sup>.

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**Figure 1.** ALFALFA HI flux contours superposed on a DSS2 Blue Image. The black contour at  $0.4 \text{ Jy beam}^{-1} \text{ km s}^{-1}$ , integrated over  $1956 - 2139 \text{ km s}^{-1}$ , encompasses the approximate area of the HI envelope detected by Hoffman *et al.* (1993). Blue contours show tail emission integrated over  $1784 - 1836 \text{ km s}^{-1}$ , with contours at  $0.17, 0.25, 0.35, 0.45, 0.55, 0.7, 0.9 \text{ Jy beam}^{-1} \text{ km s}^{-1}$ . Red contours show tail emission integrated over  $1868$  and  $1930 \text{ km s}^{-1}$ , with contours at  $0.23, 0.4, 0.6, 0.9, 1.2, 1.7,$  and  $2.5 \text{ Jy beam}^{-1} \text{ km s}^{-1}$ .

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).

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### 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*, in press
- Hoffman, G. L. *et al.* 1993, *AJ*, 106, 39
- Hoffman, G. L. *et al.* 1999, *AJ*, 117, 811
- Kent *et al.* 2007 *ApJ*, in press