



The ALFA Zone of Avoidance Survey: Results from the Precursor Observations



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Introduction

We present new extragalactic 21 cm observations in the Galactic Plane region. These observations are a precursor to a large scale, extragalactic, Zone of Avoidance (ZOA) survey with the Arecibo L-band Feed Array (ALFA). The data for this survey are being taken concurrently with a Galactic survey and a pulsar survey. Full survey observations, which will begin in 2007, will reveal local large scale structure in a part of the extragalactic sky that is relatively unexplored due to the obscuration of optical light by dust in our Galaxy. One of these surveys will have an integration time of 268 seconds per point in the inner Galaxy and 134 seconds in the outer Galaxy, covering $|b| < 5^\circ$, while the other will have an integration time of only 5 seconds per point, covering $|b| < 10^\circ$ with an rms of roughly 6 mJy. No other extragalactic ALFA survey will cover these latitudes. Precursor observations have been made using the latter observational setup on two patches of sky totaling 140 deg² (one near $l=40^\circ$, and the other near $l=192^\circ$). We have measured HI parameters for detections from these observations, and cross-correlated with the NASA/IPAC Extragalactic Database. A significant fraction of the objects are new, having never been detected at any wavelength. For those galaxies that have been previously detected, about half have no previously known redshift, and no previous HI detection.

Data Reduction

Data reduced using software originally developed for the Parkes Multibeam surveys (*LiveData*, *Gridilla*), adapted for Arecibo. Data are gridded using a median filter, taking advantage of the re-observations of sky pointings afforded by the basketweave technique. Cubes are searched by eye, parameters fit in *Miriad*. Data reduction has been completed for the entire $l=40^\circ$ region and 2/3rds of the $l=192^\circ$ region.

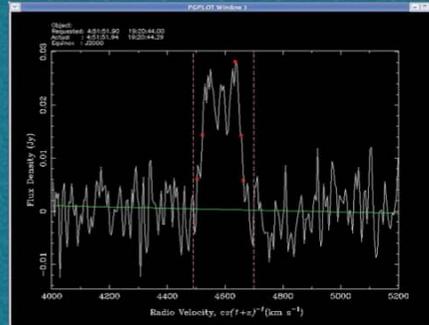


Figure 3 Spectrum of a previously unknown galaxy from the precursor observations.

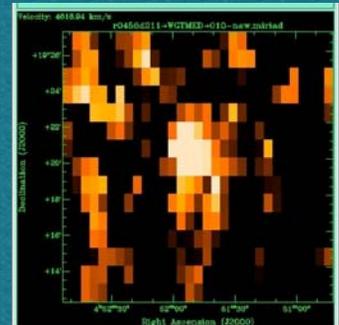


Figure 4 HI Image of the galaxy from Figure 3.

Why survey the ZOA in HI?

The ZOA has been narrowed by deep optical / IR searches, but both fail in regions of high extinction and stellar confusion. Galaxies which contain HI can be found in regions of thickest obscuration and worst IR confusion.

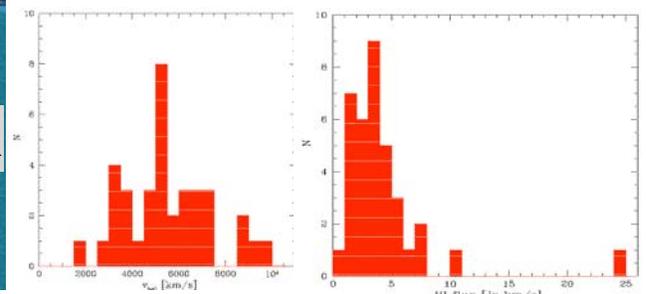
Goals of the survey:

- Reveal large scale structure in an unexplored region of the local universe
- Combine with HI detections of other ALFA surveys to produce HI mass function for tens of thousands of galaxies
- Combine with 2MASS photometry, and HI spectroscopy from the rest of the sky to produce an all sky TF catalog, producing distances and peculiar velocities for ~5000 galaxies, extending deep into ZOA (Masters *et al.* 2005)

Results

34 galaxies detected in the 70 deg² of sky reduced so far.

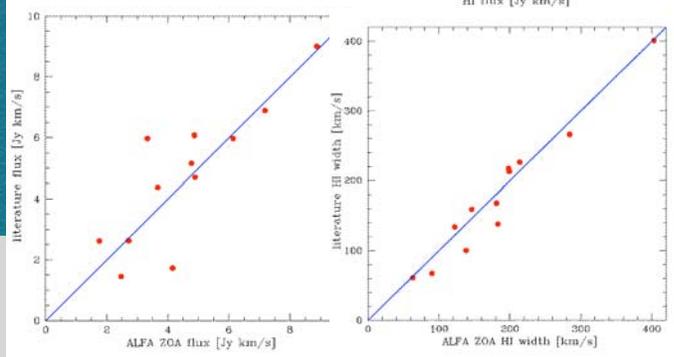
Figure 5 Left heliocentric redshift and right HI flux distributions for the 34 detections.



Of the 34 detections:

- 9 have no known counterpart—observed here for the first time
- But only 15 of the 25 known objects have previously known redshifts (mostly radio)
- 13 objects with previously known HI fluxes and widths

Figure 6 Left HI fluxes and right HI widths for galaxies with HI parameters in the literature—comparison between our values and literature values.



Our fluxes correlate more strongly with values from literature than our widths. However, width errors are typically of order ~10-15%, so most of our values are in agreement.

Precursor Observations

While the full survey will not begin until the spring of 2007, we conducted precursor observations in 2005-2006 on a 40 deg² patch of sky, in the vicinity of $l=40^\circ$, and a separate 100 deg² patch of sky near $l=192^\circ$. Each point on the sky is covered by two passes, of ~2.5 sec. integration time each.

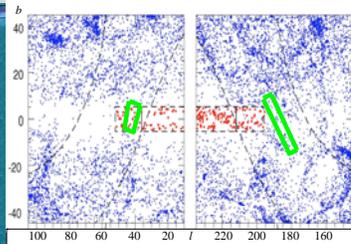


Figure 2 LEDA galaxies within 12,000 km/s in and near the two ZOA regions accessible to Arecibo, the inner (left) and outer Galaxy (right). Dashed curves show the regions of sky Arecibo can see. The rectangles containing the Galactic equator show the overlap with the HI Parkes ZOA survey, with galaxies detected by Parkes plotted with heavy dots. Green boxes indicate ALFA ZOA precursor regions.

Conclusions

- We intend to map the full ZOA in the Arecibo sky to $b = \pm 10^\circ$, with 5 sec int. time. Extrapolating from the detection rate of the precursor regions, this should yield ~900 galaxies.
- Will also map the ZOA over all longitudes within $\pm 5^\circ$ of the plane with ~30 times longer integration time.
- The majority of our detections have known counterparts in the literature, but no previously known redshifts---exploring new part of LSS.
- We find a strong correlation between our HI parameters and those from the literature.

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References

- Donley *et al.* 2005 AJ 129, 220.
- Fairall 1998, Large-Scale Structures in the Local Universe (Chichester: Wiley).
- Henning *et al.* 2006 BAAS 208, 5304.
- Masters *et al.* 2005 BAAS 37, 1427.
- Pantoja *et al.* 1997 AJ 113, 905.
- Wong *et al.* 2006 MNRAS in press (astro-ph/0607491).