Progress Report and Request for Continuation of the ALFALFA Survey
15 Sep 2009

R. Giovanelli for the ALFALFA Collaboration

ALFALFA overview: The ALFALFA (Arecibo Legacy Fast ALFA) survey aims to conduct a census of 7000 deg^2 of extragalactic HI sky out to $z < .06$ with 5 km s^{-1} resolution. The "minimum intrusion" drift scan technique adopted for ALFALFA proves extremely efficient (99% "open shutter time") and delivers very high quality data. Begun in 2005, the ALFALFA observing program (A2010) is now $\sim$ 77% complete, and five data catalogs, along with 15 additional science papers, have been published in the refereed literature. The ALFALFA database is inherently multiwavelength, providing cross-identifications to optical counterparts of the HI sources, a major advance of ALFALFA over the HI Parkes All-Sky Survey (HIPASS) made possible because of Arecibo's narrow beam far superior centroiding accuracy. The ALFALFA collaboration is an open one; new members are invited to join required only to follow the guidelines for participation in the spirit of such an open collaboration. With more than 60 members, ALFALFA continues to expand, gaining new participants engaged not only in the Arecibo HI program but also in a wide variety of coordinated followup observations at other wavelengths, HI synthesis studies, correlative data mining studies with public datasets and numerical simulations. The ALFALFA data are also being used as a testbed for foreground subtraction schemes of importance for high redshift HI intensity mapping experiments. Three ALFALFA-rooted Ph.D. theses have been completed; more than ten others are underway. The observing program, multiwavelengths datasets, software development and analysis tasks provide fertile territory for student training and involvement at both the graduate and undergraduate level. One especially successful focus of the ALFALFA program engages faculty at 14 principally undergraduate teaching institutions in an active scientific collaboration specifically designed to meet their needs and circumstances.

ALFALFA documents: In previous reports for the annual NAIC skeptical review, we have provided details of the observing program and strategy, data processing scheme, IDL-based analysis software, database development activities, outreach activities and science results. By nature of its broad, diverse and ever-expanding nature, the ALFALFA collaboration functions by means of well-developed websites containing copious information, documentation, cookbooks and software utilities. Rather than include here a lot of material which has already been submitted to the skeptical review committee and/or which can be found on our websites, we summarize details given in our 2008 report in Appendix A and refer the interested reader to the URLs of websites providing links to various documents previously submitted to NAIC or containing relevant information:

- ALFALFA survey public website
  http://egg.astro.cornell.edu/alfalfa/
- ALFALFA survey publication list
  http://egg.astro.cornell.edu/alfalfa/pubs.php
- ALFALFA survey projects
  http://egg.astro.cornell.edu/alfalfa/projects.php
- ALFALFA undergraduate team website
  http://egg.astro.cornell.edu/alfalfa/ugrad.php
- ALFALFA documentation website (including the original proposal and prior annual reports)
  http://egg.astro.cornell.edu/alfalfa/docs/index.php
- ALFALFA observing team website
  http://www.naic.edu/~a2010/galaxy_a2010.html

- ALFALFA team IDL website
  http://caborojo.astro.cornell.edu/alfalfalogs/docs/idldoc.php
- Cornell HI digital archive website
  http://arecibo.tc.cornell.edu/hiarchive

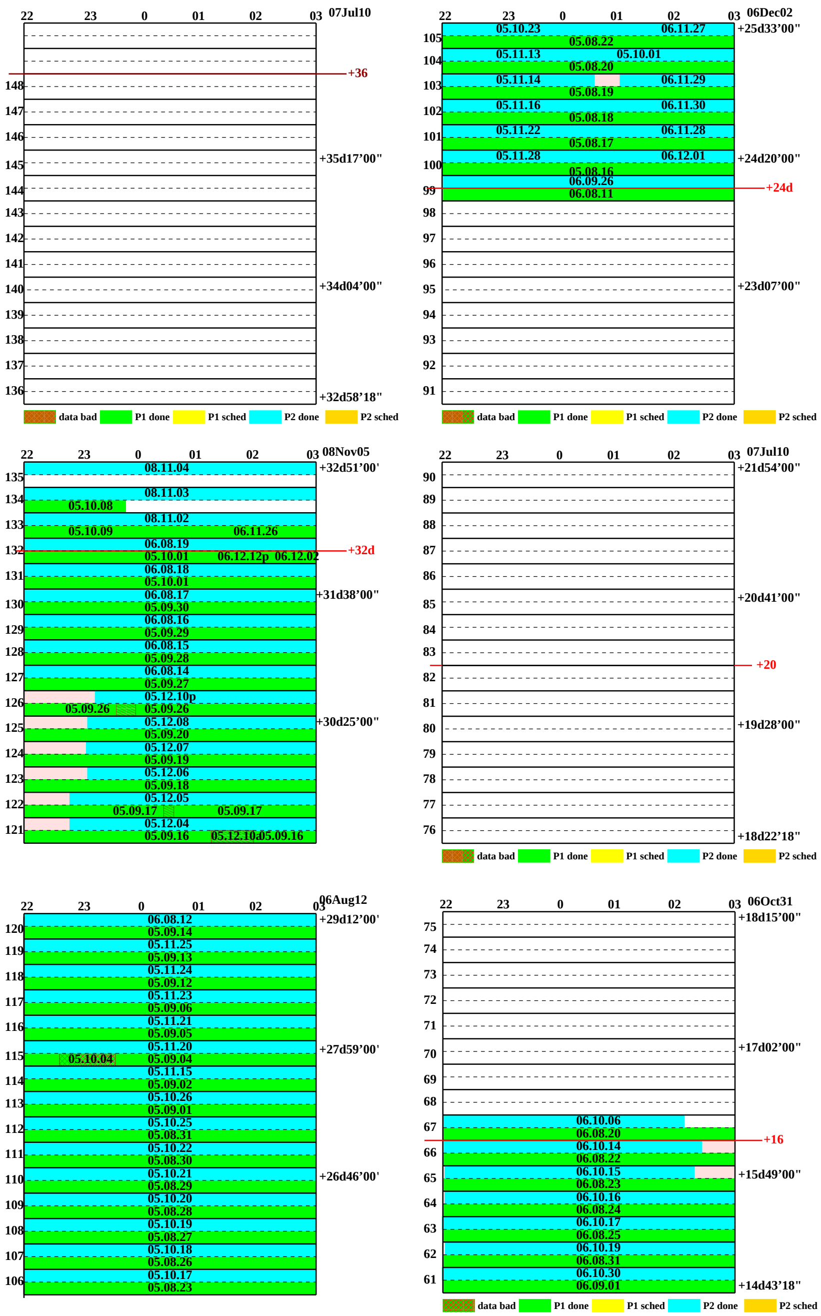
ALFALFA highlights since July 2008

As described in previous reports, the ALFALFA collaboration is engaged in many activities which revolve around the survey and its applications for science, education, training and outreach. Here we provide only updated information which specifically outlines the current status of the A2010 observing program and ALFALFA survey team accomplishments in the last year. Previous annual reports contain earlier highlights and summary details, extracted from last year's report, includes a description of ALFALFA team duties and organization, are provided in Appendix A.

A2010 Observational Program: As of 12Sep2009, Project A2010 has been scheduled for about 3400 hours of telescope time or 77% of the original request. Observations have been conducted on 585 separate observing sessions, each one of which is overseen by a trained ALFALFA observer. A2010 conducts **no** observations in absentee or service mode. Most of the observations are conducted remotely from a variety of locations, but a trained observer monitors the data in real time and performs a series of quality verification checks throughout the full duration of each run. The A2010 observer also runs a calibration script for the TOGS program before and after each ALFALFA observing session. The attention to data quality is especially critical because of frequent failures of the WAPP hardware and intermittent RFI. By having an observer keeping a watchful eye on the data taking, we are able to recover quickly from WAPP failures and to report unexpected RFI on short timescales. The first stage of data processing (Level I) involving calibration and bandpass subtraction is normally achieved on all ALFALFA datasets within a few days (usually the next day) of each observing run. This process likewise will uncover any hardware, software or RFI issues. The bottom line is that the A2010 program operates extremely smoothly under a meticulous protocol.

As noted above, about 77% of the requested observing time has been allocated to A2010 to date. Of those 3400 hours, a bit more than 100 hours have been lost due to hardware failure or telescope closure due to hurricanes, and about 200 hours have been allocated as setup time or cover lst ranges which do not conform to the prime map area. Our strategy is dictated by the desire to produce intermediate science results and to give priority to datasets required for on-going Ph.D. theses.

Graphical illustrations of the actual map coverage as of 12 Sep 2009 are shown in Figure 1 for the "fall" sky, 22^h <R.A.< 3^h and Figure 2 for the "spring" sky: 7^h30^m <R.A.< 16^h30^m (right), separately. Completed observations of each area in the two passes are illustrated separately, with green highlighting the first pass, and cyan, the second. The date of each observing block is indicated as YY.MM.DD. Bad data are highlighted in brown and are generally replaced by a second set of observations. Pink shaded areas denote those intended to be mapped in the current scheduling year. Full resolution, updated images can be found at *http://egg.astro.cornell.edu/alfalfa/scheds/index.php* along with more detail summary information of completed and planned observations.



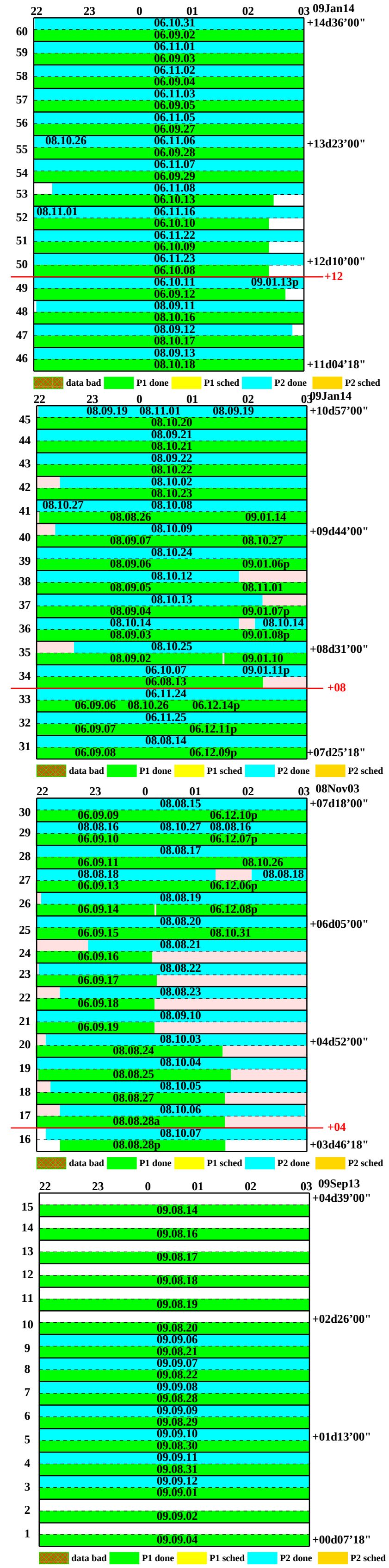
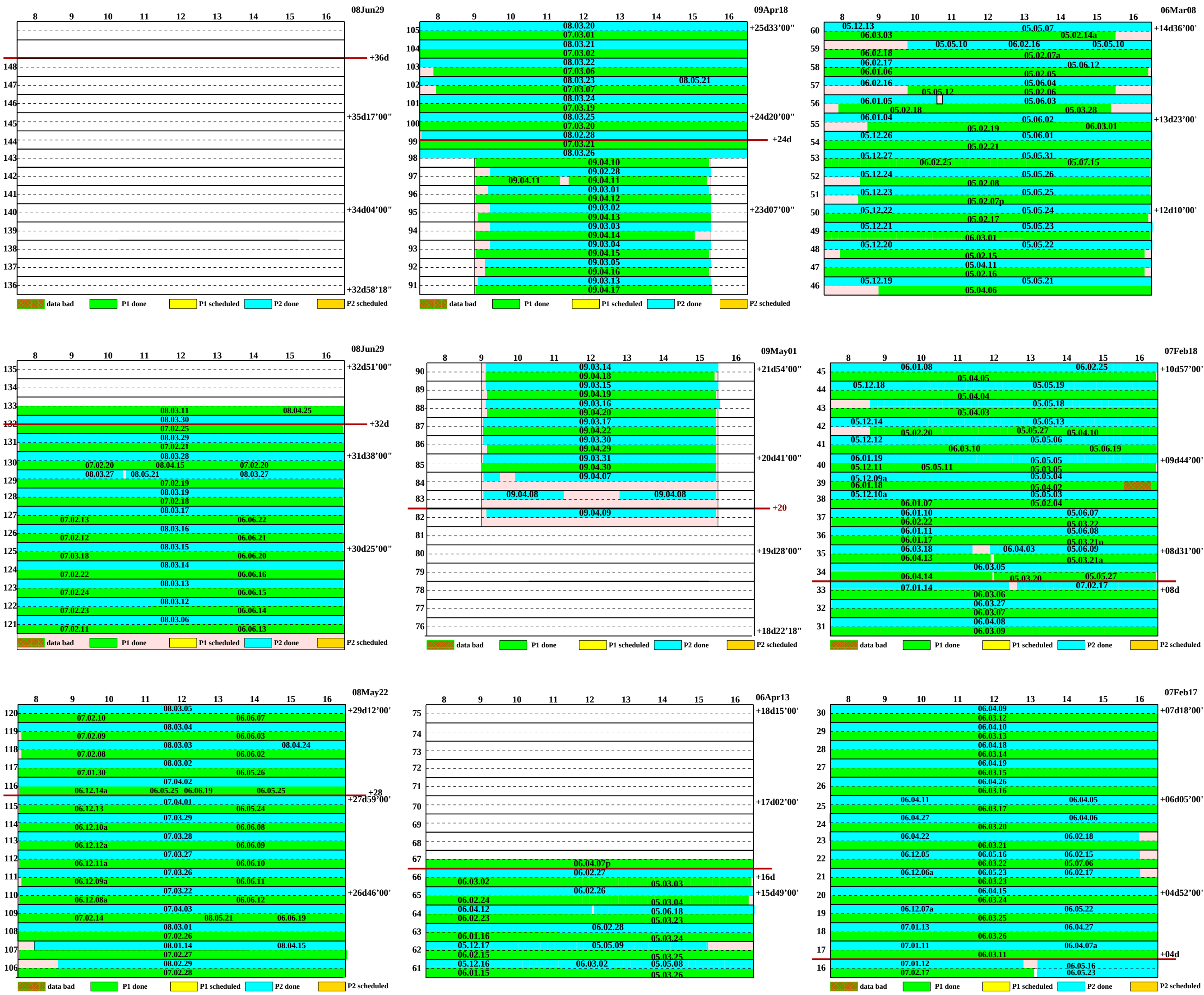


Figure 1: Actual A2010 sky coverage for “Fall” area:
22^h00^m <R.A.< 03^h00^m as of 12Sep2009.
The vertical axis is declination, indicated by ALFALFA drift designation.
Both passes are indicated, along with observing dates.
No data were acquired during Fall 2007.
Higher resolution images are available at:
http://egg.astro.cornell.edu/alfalfa/scheds/status_fall09.php



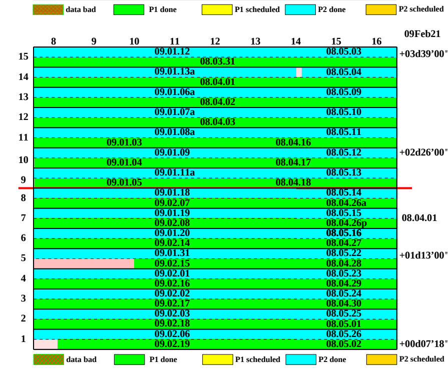


Figure 2: Actual A2010 sky coverage for "Spring" area:
$7^h30^m <$ R.A.$< 16^h30^m$ as of 12Sep2009.
Both passes are indicated, along with observing dates.
Note that, because of conflict with the AUDS program,
A2010 is now being scheduled only between $9^h <$ R.A. $< 15^h30^m$.
Higher resolution images are updated regularly at:
http://egg.astro.cornell.edu/alfalfa/scheds/status_spr09.php

We can summarize the coverage as follows:

Fall 22^h <**R.A.**< 3^h: Data acquisition, Level I and Level II processing are complete for the contiguous region extending from +24° < Dec. < +32° and also for the strip of grids at Dec. = < +15°. Data have also been acquired and Level I processing complete for the region from +06° < Dec. < +14°; Level II processing of this region is underway. The declination zone from +00° < Dec. < +06° is largely covered; we hope to complete it later in Fall 2009 after the ALFA servicing. Our prime objective is to acquire all the data required for complete processing of the set of grids at Dec. = < +01° which will comprise a major part of the Ph.D. thesis research of graduate student David Stark of the U. North Carolina. Unfortunately, it does not appear likely that the fall region will be completed until 2011.

Spring 07^h30^m <**R.A.**< 16^h30^m: Data acquisition, Level I and Level II processing are complete for the contiguous region extending from +04° < Dec. < +16° and also for the strip of grids at Dec. = +27°. Level I processing has just been completed also for the sets of grids at Dec. = +03° and +25° and will be completed in the next few months for the grids at Dec. = +01°. Additionally, data acquisition for the zone from +20° < Dec. < +24° is largely complete. Currently, our allocation has been reduced by 2.25 hours because of conflict with the AUDS program, so that our map in the intermediate declinations around the zenith covers only 08^h45^m <R.A.< 15^h30^m. With a substantial allocation of telescope time in spring 2010, we could complete the ALFALFA survey region in that part of the sky, minus the part now restricted by the conflict with the AUDS program.

2009 ALFALFA Science Highlights:

The scientific landscape of ALFALFA is extremely fertile and there are now many studies underway to reap its harvest. Here we summarize briefly, by means of some illustrative examples, the kinds of scientific results which have come about since our last report in August 2008. For earlier results and details, the interested reader is referred to our earlier reports and to our publications website.

HI census: One of the principal goals of the ALFALFA survey is the production of a catalog of HI line redshifts, velocity widths and flux densities for a well-characterized sample of galaxies spread over a cosmologically significant volume. For any position in the ALFALFA spectral grids, the upper limit to the HI line flux can also yield scientific value, and profile stacking allows the determination of the statistical properties of samples detected as an ensemble but not individually. In comparison with galaxies cataloged by optical/NIR surveys, HI samples are biased in favor of the gas-rich star forming galaxies known to avoid clusters and, rather, to dominate the populations inhabiting the vast low density volumes of the local universe. ALFALFA is especially designed to detect the gas-rich population of low mass halos, often the metal-poor "late bloomers" of cosmic star formation history. The ALFALFA legacy will contribute measures of HI mass for several tens of thousands of objects whose stellar populations and star formation characteristics have been characterized by other surveys such as SDSS, 2MASS, GALEX and Herschel. The combination on HI line widths and optical measures of inclination and size yield estimates of total dynamical mass and distance via the Tully-Fisher relation.

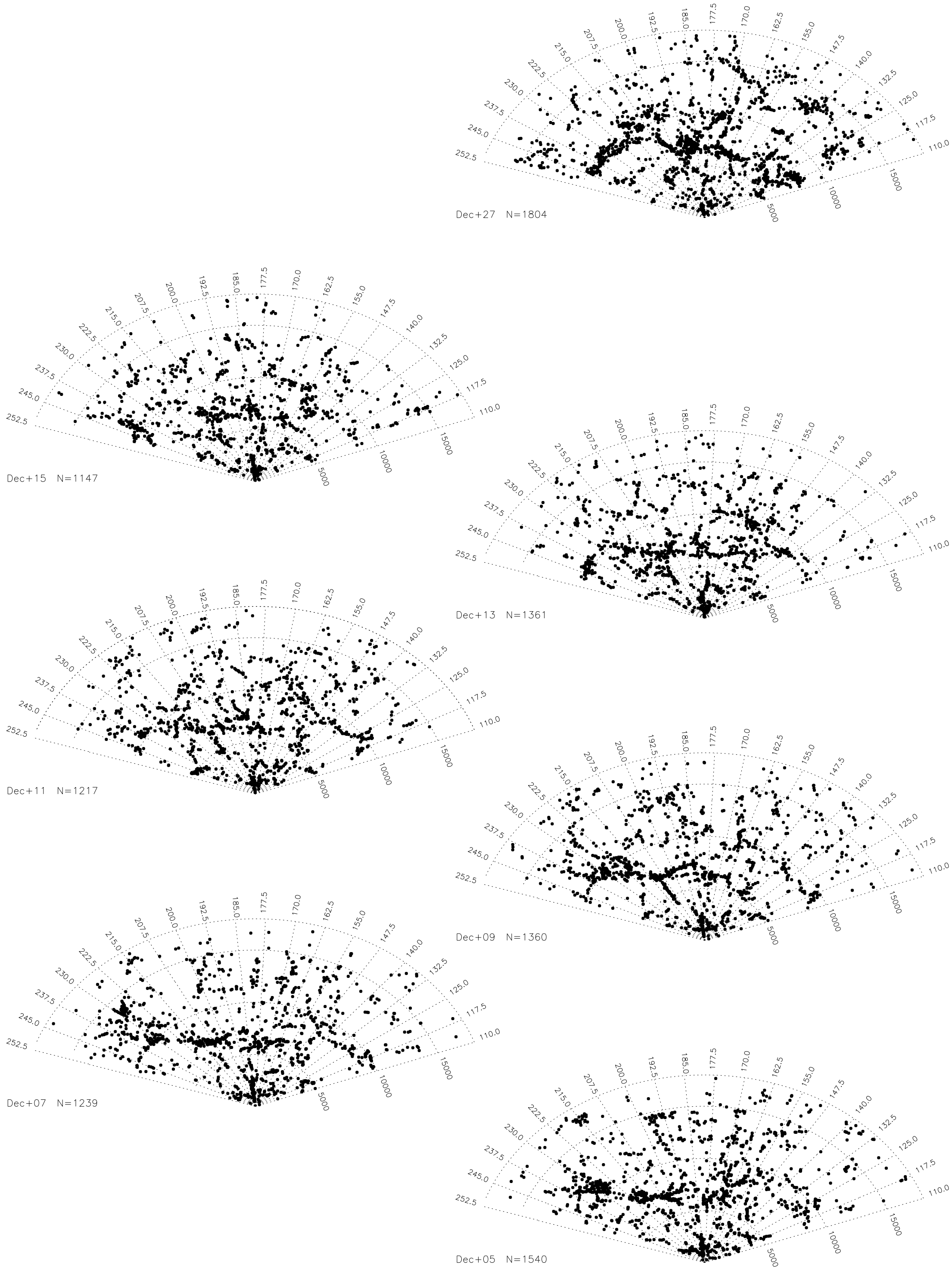


Figure 3: Cone diagrams showing the ALFALFA detections in 2° slices of the "spring" sky centered at Dec. = (from bottom to top): +05°, +07°, +09°, +11°, +13°, +15° and +27°. The progressive change of large scale structure can be followed among the lower six contiguous but statistically independent samples.

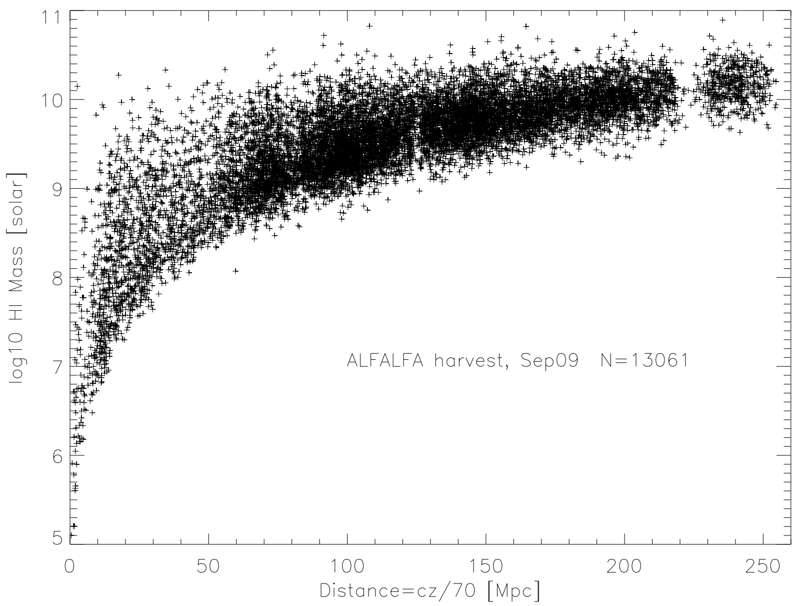


Figure 4: Spänhauer diagram showing the distribution of 10780 high quality HI detections and 2274 "priors" (lower S/N but with a likely optical counterpart of coincident redshift) in the current working ALFALFA catalog. The apparent gap at D = 230 Mpc is an artifact arising from the San Juan airport radar at 1350 MHz. A principal legacy contribution of ALFALFA will be the measurement of gas content for several tens of thousands of galaxies.

Figures 3 and 4 are intended to convey the sense of richness of the ALFALFA population. In numerical count, the ALFALFA yield has now exceeded the number of pre-ALFALFA known HI sources. Several ALFALFA team projects involve the comparison of the galaxy population detected by ALFALFA in comparison with populations sampled by other multiwavelength legacy surveys. Figure 5 shows the surprising diversity in the population of HI rich early type galaxies. Some HI-rich elliptical galaxies are quite blue and are currently forming stars.

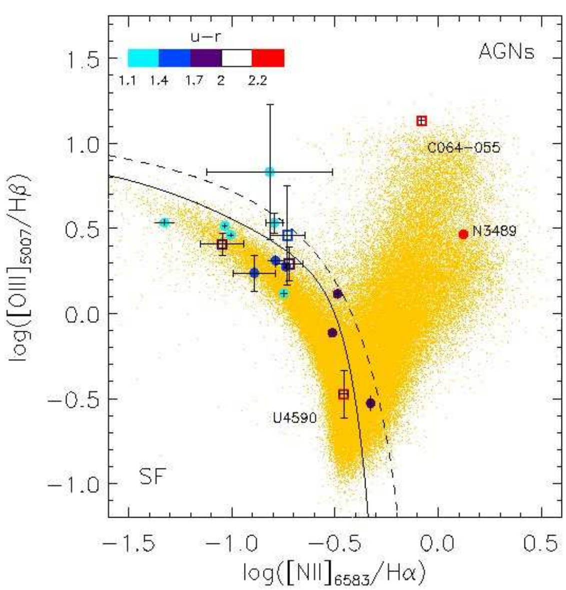


Figure 5: Location of the HI rich early type galaxies in the typical optical line diagnostic diagram used to distinguish star forming and active galaxies. From Grossi *et al.* (2009).

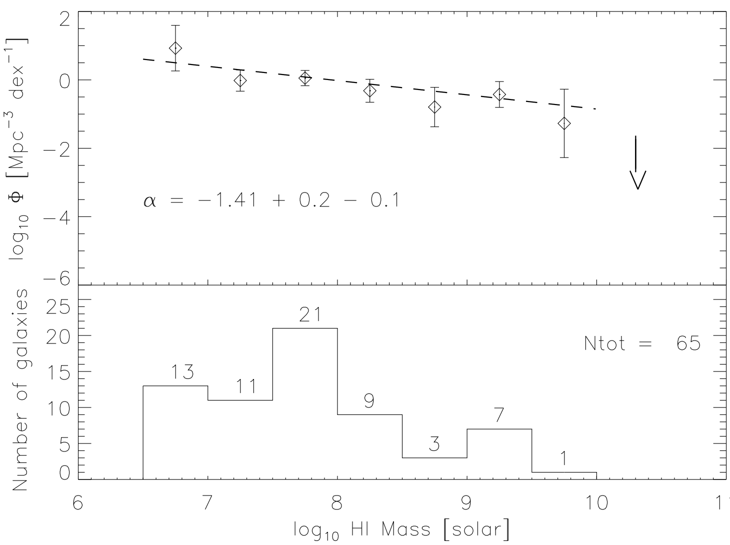


Figure 6: The HIMF for the Leo I group with a linear fit overplotted. The number of low HI mass objects in the Leo I sample is much larger than that used in previous determinations of the HIMF (more than twice as many as in the entire HIPASS sample); there are no massive HI galaxies in Leo. The low mass slope is steeper than that determined for the optical luminosity function. From Stierwalt *et al.* (2009).

Faint end of the HI mass function: As discussed in the ALFALFA proposal, ALFALFA offers unprecedented sensitivity and wide areal coverage for the study of low HI mass dwarf galaxies in nearby groups. The number of low HI mass ($M_{HI} < 10^8\ M_{\odot}$) objects detected by ALFALFA now numbers in the hundreds; we are beginning to have adequate statistical samples to anchor the faint end slope of the HI mass function and to probe their nature and distribution as a class. One of the early ALFALFA targets was selected to be the complex Local Supercluster structures in the Leo region. For her Ph.D. thesis, Sabrina Stiewalt (Stierwalt 2009) has derived the HIMF for Leo I, shown in Figure 6. The ALFALFA results suggest the existence of a significant population of low surface brightness, gas-rich, yet still very low HI mass galaxies, but the slope still falls short of the values predicted by simulations of structure formation in the ΛCDM paradigm (Stierwalt *et al.* 2009).

Baryons in faint dwarfs: Dwarf galaxies constitute the most numerous extragalactic population comprising 80-90% of the galaxies in the Local Group and ∼85% of the objects in the volume within 10 Mpc. In hierarchical clustering models, dwarf galaxies may be the building blocks of the more massive galaxies we see today. Identified by their HI mass and low rotational velocity rather than optical luminosity or surface brightness, the ALFALFA low mass sample offers a unique window on the evolution of gas-rich low mass halos in the local universe. A coordinated campaign of multiwavelength observations is allowing us to study how some low mass halos have formed their stars, retained their gas despite their fragile thermal state and shallow potential wells, and enriched themselves chemically. Coordinated campaigns are ongoing to derive star formation rates and histories from multiwavelength imaging, to derive nebular abundances from optical spectroscopy and to map their HI distribution and kinematics.

An interesting pattern appears to be emerging from preliminary followup HI synthesis observations (Saintonge, Cannon, Begum) at the VLA and GMRT of very low mass systems: in some objects, the HI mass seems to comprise a large fraction of the dynamical mass needed to explain the kinematics within the edge of the observed emission, against expectations from simulations that low mass halos should be unable to retain their baryons.

Interacting galaxies and the formation of tidal dwarfs: With the majority of present-day

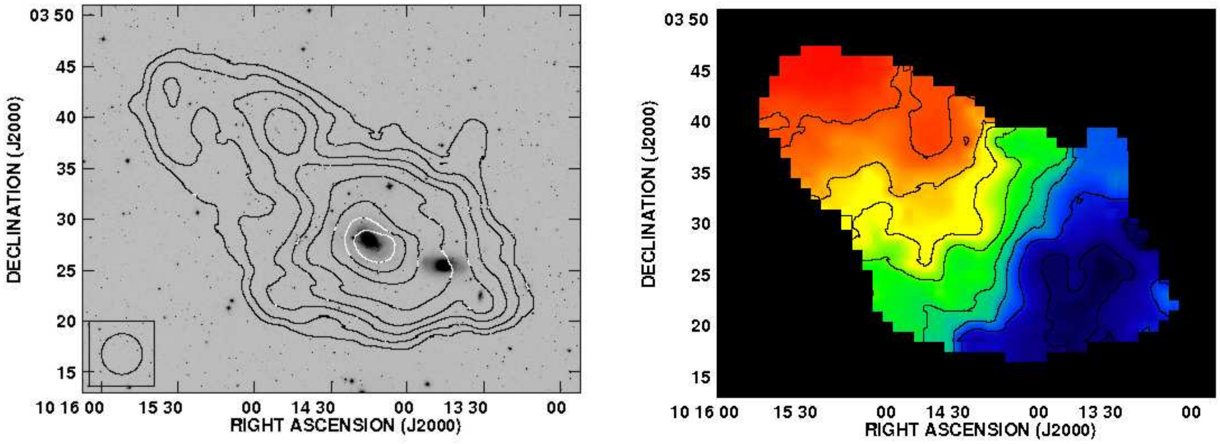


Figure 7: HI distribution in the NGC 3169 group. Left: Total HI intensity map of the N 3166/9 group core obtained by ALFALFA, superimposed on the SDSS r-band image. Contours are at (0.2,0.5,1,2,3.5,7,15,25,35,50) $\times 1.9 X 10^{19}$ cm-2; the ALFALFA beam is superposed. Right: The corresponding intensity weighted HI velocity map; contours are at (950, 1000, 1050, ... 1350) km s^{-1}. The bright galaxies NGC 3165, 3166 and 3169 are easily visible; several other faint galaxies, including tidal dwarf candidates are embedded in the extended HI distribution. From Spekkens *et al.* (2010).

galaxies residing in groups, these intermediate density environments play an important role in driving galaxy evolution. Interactions in groups can lead to the formation of "tidal dwarfs" out of debris. Systems formed in such interactions should be distinguishable from their primordial dwarf counterparts by a relative lack of dark matter and deviation from the normal metallicity–luminosity relation. The identification and study of tidal dwarfs in loose groups is critical to our understanding of the contribution of these second-generation objects to the overall dwarf population.

One of the systems covered by ALFALFA recently is the spiral-dominated group of galaxies around N 3166/9, lying at about 22 Mpc. Extensive HI emission associated with N 3166/9 was discovered in an early Arecibo survey using the "flat feed" (Haynes 1979). Figure 7 shows the morphology and kinematics for the core of the group as derived from the ALFALFA observations. SDSS photometry reveals a wealth of faint, previously uncatalogued dwarfs in the vicinity of the brightest group members. A handful of systems coincide with narrow-linewidth HI peaks, suggesting that they are *bona-fide* gas-rich group members. Followup optical imaging and optical spectroscopy obtained by the ALFALFA team implies active star formation in several of them; metal abundances are being derived from Palomar spectra to test the tidal dwarf origin hypothesis. A proposal to undertake a mosaic study of the extended HI distribution in this system with the GMRT is scheduled for late 2009.

The Undergraduate ALFALFA Team (UAT) Groups of Galaxies Project: Nearby groups of galaxies provide useful laboratories for studies of the impact of environment on gas content, morphology, star formation rate, nuclear activity, etc. Members of the UAT have begun a collaborative study of selected groups of galaxies included in the ALFALFA volume. Using ALFALFA and complementary data available in the literature or from digital databases like SDSS, trends in stellar mass, color, gas content, location within the group, etc are being investigated in a coordinated fashion. By pooling together the work undertaken by different institutions within the UAT, we aim to undertake a comparative study of environmental effects in groups of different richness, X-ray luminosity, velocity dispersion, etc. This project involves undergraduates at the participating institutions, is forming the basis of numerous senior thesis/research projects and fosters the continued

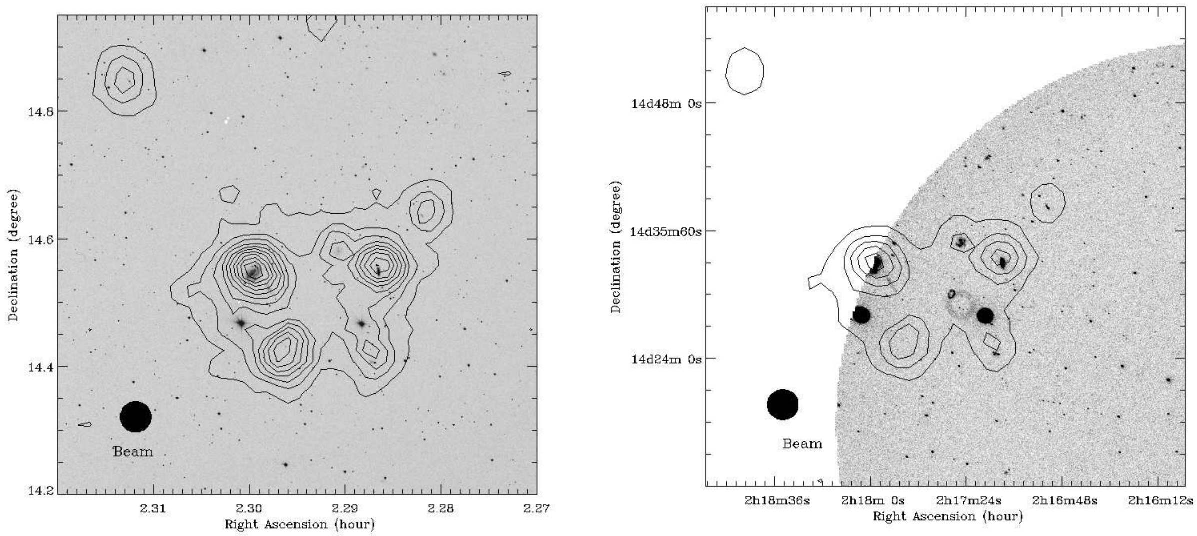


Figure 8: An illustrative example from the UAT groups of galaxies project. Left: ALFALFA HI distribution in the N 877 group region superposed on the DSS2 blue image; right: same contours superposed on the edge of the GALEX UV image. Although the pointing of the GALEX image is not ideal, faint UV emission appears to coincide with one of the peaks of HI where no emission is visible in the DSS2 blue image.

engagement of members of the UAT, most of whom teach at principally undergraduate institutions. Telecons are held regularly to discuss issues associated with science and data analysis, tasks are coordinated and resources exchanged. This work also focuses the student presentations at the annual UAT workshop held at Arecibo and a mini-workshops held during the summer, such as one held at Union College on July 29, 2009. Team members, including undergraduate students, from Colgate, Siena, Skidmore and Siena met at Union College for the day while others from Cornell, George Mason, Georgia Southern, Lafayette and St. Lawrence joined by telecon. Students gave progress reports on their work to date, and faculty discussed how to coordinate efforts to perform the science analysis. See: *http://egg.astro.cornell.edu/alfalfa/ugradteam/uat_union0907.php*. Because the number of groups sampled by ALFALFA grows as its catalog grows, this program is well-suited to accomodate additional undergraduate students as the project progresses. Furthermore, more senior students can pass along their understanding to more junior ones who would then apply the same methodology to the newer datasets, creating the opportunity for peer instruction and learning.

As an example of an undergraduate contribution to the entire ALFALFA team, Figure 8 shows a product of the summer REU experience of Tess Senty, a senior at Humboldt State University. As a summer NSF-REU student at Cornell, Tess examined a number of fields noted as containing extensive HI distributions, comparing the ALFALFA maps to optical and UV images and to previous observations available in the literature. Though she had only a little familiarity with IDL beforehand (from her previous trips to the Jan 2009 UAT workshop and an observing trip to Arecibo with her adviser Dave Kornreich), Tess streamlined the IDL-ALFALFA code used to generate cone and contour diagrams and to make overlays of the HI contours on optical images. The fruits of her programming efforts are being shared with other members of the ALFALFA team as part of the IDL-ALFALFA distribution, and VLA observations to explore the nature of the "almost dark" object evident in Figure 8 are underway.

ALFALFA Refereed Papers since Aug 1, 2008:

1. *The faint outer regions of the Pegasus Dwarf Irregular galaxy: a much larger and undisturbed galaxy* Kniazev, A., Brosch, N., Hoffman, G.L., Grebel, E.K., Zucker, D.B., & Pustilnik, S.A. 2009, MNRAS (in press)
2. *The Arecibo Legacy Fast ALFA Survey: IX. The Leo Region HI Catalog, Group Membership and the HI Mass Function for the Leo I Group* Stierwalt, S., Haynes, M.P., Giovanelli, R., Kent, B.R., Martin, A.M., Saintonge, A., Karachentsev, I.D. & Karachentseva, V.E. 2009, Astro. J. 138, 338
3. *The Arecibo Legacy Fast ALFA Survey: VIII. HI Source Catalog of the Anti-Virgo Region at* $\delta = +25°$ Martin, A.M., Giovanelli, R., Haynes, M.P., Saintonge, A., Hoffman, G.L., Kent, B.R. & Stierwalt, S. 2009, ApJS 183, 214
4. *The HI Content of Early-Type Galaxies from the ALFALFA Survey: II. The Case of Low Density Environments* Grossi, M., di Serego Alighieri, S., Giovanardi, C., Gavazzi, G., Giovanelli, R., Haynes, M.P., Kent, B.R., Pellegrini, S., Stierwalt, S., & Trinchieri, G. 2009, A&A 498, 407
5. *The Arecibo Legacy Fast ALFA Survey VII: A Neutral Hydrogen Cloud Complex in the Virgo Cluster* Kent, B.R., Spekkens, K., Giovanelli, R., Haynes, M.P., Momjian, E., Cortes, J.R., Hardy, E. & West, A. 2009, Ap.J. 691, 1595
6. *The NGC 672 and NGC 784 Galaxy Groups: Evidence for Galaxy Formation and Growth along a Nearby Dark Matter Filament* Zitrin A. & Brosch, N. 2008, MNRAS 390, 408

In addition, a number of papers and posters were presented at conferences by team members. For a complete listing, see *http://egg.astro.cornell.edu/alfalfa/pubs.php*.

Continued growth of the ALFALFA Team

In keeping with the adopted ALFALFA guidelines for the science collaboration, a number of new, specific science projects, have been proposed and approved by the ALFALFA Oversight Committee; more are expected in the coming months. Active project summaries can be found at *http://egg.astro.cornell.edu/alfalfa/projects/projects.php*. Of particular note, ALFALFA serves as the cornerstone of several major spin-off projects which are closely linked to other on-going surveys initiated or proposed in 2009.

GASS: The GALEX-Arecibo-SDSS survey (GASS: D. Schiminovich PI) aims to acquire the observational data required to establish robust scaling relations between the gaseous and stellar components of massive galaxies. GASS targets galaxies in the so-called "green-valley" between the red sequence and the blue cloud, objects with typical stellar masses of 3×10^{10} $M_\odot$. The most gas-rich of these are detected by ALFALFA, and access to the ALFALFA catalog and dataset is critical to optimize the target selection for GASS. Furthermore, graduate student Silvia Fabello (MPA) is using the ALFALFA data cubes to "stack profiles", thereby allowing the measurement of HI line fluxes for ensembles of SDSS and GALEX selected galaxies which would not individually be detected by ALFALFA. The combined GASS-ALFALFA team has also proposed to conduct a legacy 3mm CO line program with the IRAM 30 m telescope for a sample of 300 GASS targets to probe the characteristic contribution of coldest gas to the total gas content.

RESOLVE: The RESOLVE survey (S. Kannappan P.I.) attempts to obtain a census of stellar, gas and dynamical mass for every galaxy in two equatorial volumes which coincide with the peak of the

ALFALFA redshift-sensitivity range. RESOLVE integrates the multiwavelength surveys that trace stars at UV/Opt/IR wavelengths and will contribute spatially resolved kinematics derived from optical spectroscopy. ALFALFA will provide uniform-quality HI fluxes or upper limits for every galaxy in RESOLVE where the two surveys overlap. Since part of the important SDSS "Stripe 82" lies below the ALFALFA declination cut-off at the equator, the RESOLVE team has proposed, in a separate proposal, to extend ALFALFA in the fall sky region to the southern Arecibo limit. As a result of the strong interest of the RESOLVE team in having access to the ALFALFA dataset in a timely manner, we completed ALFALFA coverage of the spring region as far south as the equator in 2009 and hope to complete the fall portion later this fall. The RESOLVE-ALFALFA coordination will comprise part of the PhD thesis research of UNC graduate student David Stark.

Making Hay with ALFALFA: Measuring the local SFR density is of fundamental importance since it is the anchor point for assessing the evolution of the star-formation history of the universe. Mapping the evolution of the SFR density has been the focus of much attention in the past decade, but nearly all of the eort has been on measuring it at medium and high redshifts. For local estimates, most studies have adopted values obtained using objective-prism samples of star-forming galaxies. While these types of ELG samples provide good solid estimates of the local SFR density, they can only be thought of as providing lower limits, since they are only sensitive to the galaxies with the highest levels of activity. An adequate measure of the cosmic SFR density requires inclusion of *all* star formation in *all* galaxies. Blind HI surveys provide the perfect sample for this type of study, since they include all galaxies that have the fuel necessary to make stars. Furthermore, narrow-band imaging is the most ecient way to measure all of the current star-formation activity, since most galaxies in the local samples are extended. ALFALFA is the only HI survey deep enough to sample a fair volume of the Universe. Several Hα imaging programs are currently under way using ALFALFA catalogs, yielding hundreds of images, typically at $cz < 5300$ km s^{-1}, which are being used for a variety of applications. John Salzer of Indiana University is leading the effort to extend the Hα imaging survey at Kitt Peak to $cz = 8000$ km s^{-1}. This survey will provide the ultimate large-scale determination of the SFR at $z = 0$.

The ALFALFA-U Collaboration: With the successful approval of a request to NSF for additional funding, the ALFALFA-U team was expanded in 2009 to 16 institutions engaged in an NSF-sponsored program to promote undergraduate research within the ALFALFA project. Current institutional members are Colgate, Cornell, George Mason, Georgia Southern, Humboldt State, Lafayette, St. Lawrence, St. Mary's College of California, Siena, Skidmore, Union, University of Puerto Rico - Rio Piedras, University of Wisconsin - Madison, University of Wisconsin - Stevens Point, Wesleyan University and West Texas A&M. Funding is provided by an NSF grant to R. Koopmann (Union), T. Balonek (Colgate, and S. Higdon (Georgia Southern) which provides summer research stipends for seven undergraduates, computer hardware and software licenses for each institution, communications support for regular teleconferences, and travel support for observing and attendance at the annual workshop in Arecibo. A second Undergraduate ALFALFA workshop was held at Arecibo January 12-14, 2009. All of the team member institutions participated. Lectures were given by Haynes, Giovanelli, Kornreich, Martin, Stierwalt and Hoffman, several A2010 observing sessions were conducted overnight, and the whole group was kept busy undertaking a series of ALFALFA-based educational "scavenger hunts". It was a huge success; see: *http://egg.astro.cornell.edu/alfalfa/ugradteam/ugradj09.php.*

Student involvement: ALFALFA remains the focal point for student training and research for a large number of graduate and undergraduate students. Lists of undergraduate and graduate students engaged in research based on ALFALFA are included as Appendix B and C respectively.

For her Ph.D. thesis (defended in July 2009; Cornell degree to be awarded January 2010), Sabrina Stierwalt conducted a study of the dwarf galaxy population as revealed by ALFALFA in the region of the Leo group. In August 2009, she began a postdoctoral position at Caltech, working on Spitzer observations of dwarf galaxies and the KINGFISH Herschel key project.

While most ALFALFA observing is done remotely, the on-site observing experience is critical for new participants especially students. During the last year, ALFALFA observations were conducted at Arecibo by new ALFALFA team members Cameron Arsenault (grad student, Royal Military College of Canada), Betsey Adams (grad student, Cornell), Shan Huang (grad student, Cornell), Steven Margell (undergrad, HSU), Tess Senty (undergrad, HSU), and the entire contingent attending the UAT workshop. Additionally, several graduate students from other universities have paid extended visits to Cornell for training in ALFALFA software and data reduction and for research planning. During the past year, visitors included graduate students Silvia Fabello (MPA-Garching), Kelley Hess (U. Wisconsin) and David Stark (U. North Carolina) who spent periods in Ithaca working with Giovanelli and Haynes on ALFALFA data analysis and its incorporation into their various Ph.D. thesis projects.

Software development in 2008-9: Software development for ALFALFA has proceeded mainly in the areas of final signal extraction and identification. To mention a few: • Silvia Fabello, a graduate student at Munich, has spent several weeks in Ithaca developing a tool to stack ALFALFA images centered on optical galaxies of known redshift and similar optical characteristics, independently undetected by ALFALFA, to obtain detections or upper limits of a category of objects, rather than single ones. The stacking approach allows us to reach much fainter flux limits than the typical 2–3 mJY rms of single galaxy spectral profiles.• Undergraduate Tess Senty of Humboldt State U. spent the Summer at Cornell, developing software for image combination and visualization, improving on the already excellent suite of programs our group utilizes in cross–referencing ALFALFA data with those of other surveys, especially SDSS and GALEX. • Betsey Adams, graduate student at Cornell, has been working on the development of a source finding algorithm that is optimized to capture sources of very narrow linewidth (< 30 km s^{-1}), which can often be confused with RFI and Galactic features.

Data Archive: The ALFALFA archive is available on a SQL database server at the Cornell Center for Advanced Computing (CAC; formerly CTC); see *http://arecibo.tc.cornell.edu/hiarchive.* During the last year, this server has been replaced with a new one and the ALFALFA archive has been merged with other NAIC data by Adam Brazier. We work closely with Adam to insure that our digital datasets are included in the overall NAIC archive and access planning. During the last year, we have also purchased several new data storage machines for intermediate storage and processing purposes; furthermore, we shipped a complete set of data to the Judd Bowman/Miguel Morales for their purposes of investigating foreground removal techniques. The ALFALFA archive is SQL and cone searchable and spectra can be downloaded in VOTable, FITS and ASCII format. A JAVA-script based plotting tool was developed to complement the VO-Plot tool for users who do not have access to the required plug-in. The ALFALFA spectral data are also available through the NASA Extragalactic database.

It should be noted that a major part of the ALFALFA legacy is the identification of the most probable optical counterpart. Because of its smaller beam size and higher sensitivity, ALFALFA achieves a centroiding accuracy of better than $20''$ for most sources. The ALFALFA database is inherently multiwavelength, including direct links, via VO tools, to SDSS and DSS2 images. Because the cross referencing is done as a part of the ALFALFA catalog construction process, this cross reference is a significant improvement about a blind positional cross match with the SDSS for example because that catalog often contains multiple photometric objects associated with the same galaxy and because the ALFALFA astronomer can make a selection based on color and morphology when confusion occurs. Additionally a set of notes regarding blends, confused sources and other features is included with the published source catalogs. Cross referencing adds non-trivially to the work required to produce an ALFALFA source catalog; however, we also firmly believe that the multiwavelength cross-linkage is absolutely vital to maximize ALFALFA's legacy value.

Multiwavelength followup and complementary efforts: The followup observations team is engaged in a coordinated effort to obtain a wide variety of data with other major facilities. Time has been granted for ALFALFA-related observations on the Very Large Array, the GMRT, the Green Bank Telescope, SPITZER, GALEX, the Palomar 5m telescope and the ESO/VLT. Using principally smaller telescopes at KPNO, San Pedro Martir, SMARTS/CTIO, the Wise Observatory and the VATT, the ALFALFA-Hα team is continuing the acquisition images of ALFALFA detections in a coordinated effort; a database of ALFALFA-related observations is maintained and available to team members to maximize efficiency and avoid unnecessary overlap. In addition, Kornreich, Kent and Adams are using GADGET-2 to perform numerical simulations of tidal stripping events and high speed encounters in Virgo and of tidal interactions in loose groups.

Issues of concern

Since we have not received feedback from the 2008 Skeptical Review Committee, we cannot address here any issues raised by that group, but there are several issues of concern to the ALFALFA team:

- **Spectrometer uncertainties**: At this point in time, with over 3/4 of our survey data collected, we are hesitant to change spectrometers, and we still have not tested the new E-ALFA spectrometer. The ALFALFA technical requirements of spectral resolution and bandwidth are met adequately by the WAPPs. WAPP failures have been a less common occurrence in recent months than in previous years. It thus seems most prudent to us to continue using the WAPPs so that our dataset reflects a single well-characterized hardware configuration.
- **Scheduling and sky coverage**: We understand that Arecibo telescope time, particularly in certain LST ranges, is in great demand. However, at this point, we would like to complete ALFALFA as soon as possible while the WAPPs are still available and while our team is assembled.
- **Compatibility with PALFA**: At the moment, there appears to be a conflict with running PALFA commensally with ALFALFA because of a timing issue which would cause ALFALFA to lose 13 seconds worth of data per scan rather than the current 4-6 seconds during each firing of the noise diode for calibration purposes. We trust that this problem with the PALFA spectrometer timing can be resolved, and we look forward to having PALFA join us.
- **Publication and graduate student issues**: Previous NAIC Skeptical Review Committees have recommended that we made the prompt delivery of source catalogs to the community the highest priority. In response, five source catalogs have been published and others are in preparation, that will cover about 1/3 of the final survey area. The analysis of ALFALFA grids, source extraction, flux measurement and identification of the most probable optical counterpart for each HI source is a time consuming effort and efficient strategies of data acquisition and telescope scheduling do not always map as efficiently onto catalog production, science project advancement and the typical timescale of individual graduate student involve-

ment of a few years. We have aimed for a compromise betweeen those requirements and the necessity of preserving a measure of reward for the highly valuable, hard work of our graduate students. Each student heavily involved in observing, processing data and developing software will also be first author of a data paper containing a complete catalog of sources extracted from a full–RA strip of 2° in Dec. Apart from the first, all published ALFALFA catalogs have a graduate student as first author. In the process, students become keenly familiar with all aspects of data taking, processing and management, as well as well-informed judges of data quality and on the impact of the latter on their science. With this experience, students tackle thesis projects that exploit the whole of ALFALFA data currently available in pursuit of their specific set of science goals. This approach, which meets Observatory and student needs adequately, has encountered difficulties with journal referees, who have argued that the release of partial catalogs is dispersive (even if each of our partial catalogs was larger than any previous publication of HI data) and requested that partial data catalogs be posted on the web rather than submitted for publication. Implementing that request would make our postings non–VO compliant, as by VO rules only peer reviewed data bases can appear on VO nodes. We are planning to increase the size of future catalog releases, but this is slowing our data output, for the reasons mentioned above. On the other side of the balance, ALFALFA is wide open for participation and access.

Plan for the Next Year

Our request for the next year maintains continued steady progress towards completion of the ALFALFA survey in a timely manner. The timeliness issue reflects the needs of the large number of people now invested in ALFALFA, some of whom have early career constraints to complete theses, find permanent jobs or submit tenure packages. Our immediate goals for 2010 are:

- To complete the "spring" sky coverage. To accomplish this will require a slightly greater session allocation (69 requested instead of 66) in terms of sessions (but not hours, given the AUDS conflict).
- To complete the "fall" sky coverage south of +16° (which we fear will not happen in 2009) and north of +20°. The fall region mapping cannot be completed until 2011.

Summary of Request: Completion of a single strip of ALFALFA 4° tiles in 2-pass mode requires 33 observing sessions with the second half occurring 3-9 months after the first. As of Sept 13, 2009, we need the following allocation to complete the ALFALFA project:

Season	proposed year	LST range	Dec range	# sessions
Fall	2009	21h40 to 03h15 LST	Dec < +4°	11 sessions
	2009	23h40 to 03h15 LST	Dec < +6°	4 sessions
	2009	01h15 to 03h15 LST	Dec < +6°	5 sessions
	2010	21h40 to 03h15 LST	Dec: 32 – 36°	34 sessions
	2010–11	21h40 to 03h15 LST	Dec: 16 – 24°	62 sessions
Spring	2010	07h10 to 16h45 LST	Dec: 16 – 20°	32 sessions
	2010	07h10 to 16h45 LST	Dec: 32 – 36°	37 sessions

Our request above ignores the conflict with AUDS which we understand may continue; the number of sessions would not be not reduced. We understand that it is more convenient for the AO

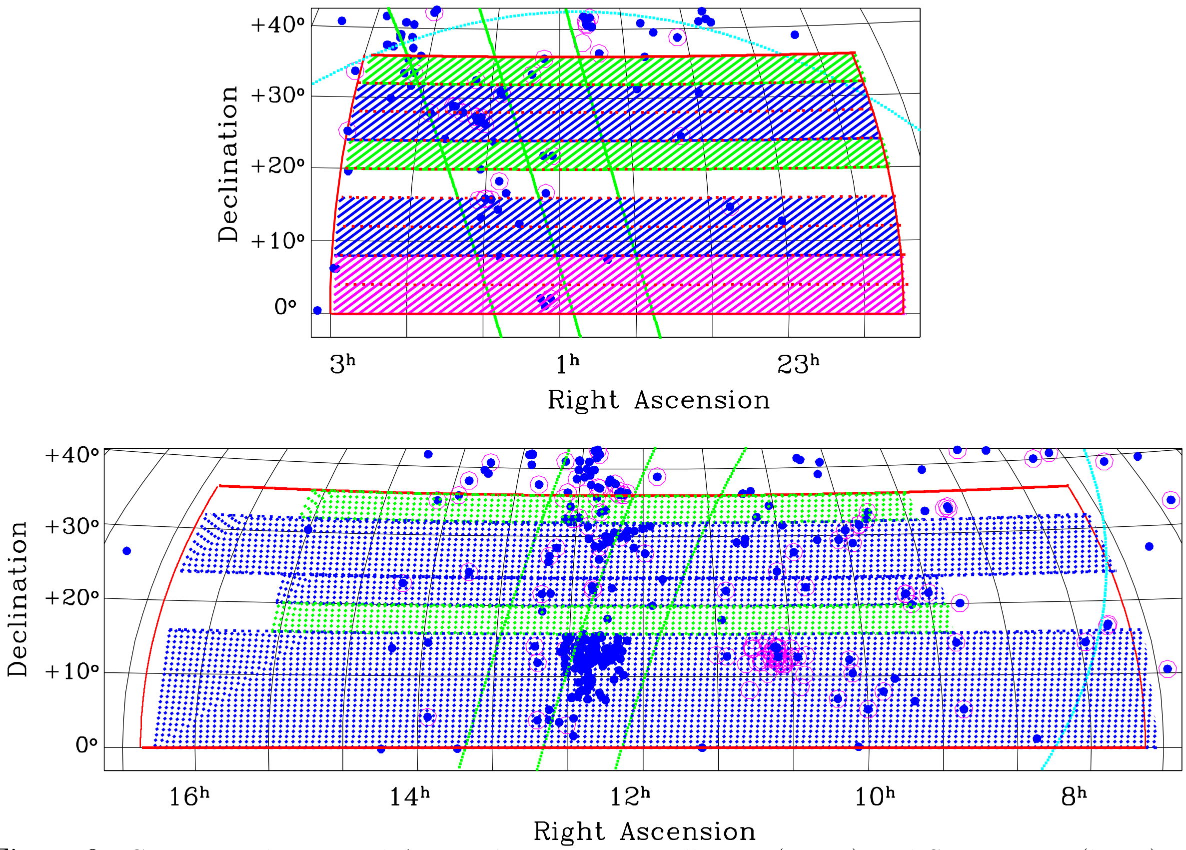


Figure 9: Current and proposed A2010 sky coverage: Fall 2010 (upper) and Spring 2010 (lower). Blue shaded areas outline the (essentially) complete coverage as of 12Sep2009; observational details are provided in Figures 1 and 2. Magenta shaded areas indicate partially completed ALFALFA tiles while green ones show the regions to be covered in 2010. The allocation requested here for the period Nov 2009-May 2010 aims to complete the ALFALFA spring region exclusive of those R.A. ranges in conflict with AUDS. In the fall region, we hope to complete before Jan 2010 the 4° wide tiles at Dec. = +06° and Dec. = +02° (magenta shaded areas). In fall 2010, we propose first to complete the zone north of Dec. = +32° and then the Dec. = +22° tile; the remaining fall sky would be completed in 2011. The solid red lines outline the proposed survey area for the full ALFALFA survey, while dotted red lines make the designated ALFALFA tile boundaries. The cyan line traces b = +20°, while the green lines trace SGL = −10°, 0° and +10°. Blue filled circles mark galaxies with observed heliocentric recessional velocities cz < 700 km s^{-1} while open magenta circles denote objects believed to lie with 10 Mpc, based largely on primary distances.

scheduler to schedule A2010 in more, but shorter blocks, which we can then stitch together to provide complete coverage of the ALFALFA survey region. Such a scheme, while somewhat less efficient and more burdensome in terms of bookkeeping, is acceptable to us as long as sky coverage is eventually completed. As always, TOGS will run commensally with ALFALFA and we anticipate that PALFA may begin to also, if the timing issues can be resolved.

APPENDIX A: ALFALFA overview extracted from 2008 report

In this section we repeat information which is of a general nature and which was presented in last year's report. It may be useful to those members of the skeptical review committee who are not familiar with ALFALFA. **Overview of ALFALFA**: ALFALFA, the Arecibo Legacy Fast ALFA Survey, is a two-pass drift scan spectral line survey intended to cover 7000 deg^2 of high galactic latitude sky visible from Arecibo, with ~eight times the sensitivity, four times the angular resolution, three times the spectral resolution, and 1.6 times the total bandwidth of HIPASS. The survey is intended to map, with complete 2-pass coverage, the region from 0° to +36° in declination and from $22^h <$R.A.$< 3^h$ (the "fall sky") and $7^h30^m <$R.A.$< 16^h30^m$ (the "spring sky"). Because of its wide areal coverage, moderate depth and photometric accuracy, ALFALFA is providing a legacy dataset for the astronomical community at large, serving as the basis for numerous studies of the local extragalactic Universe. The fixed azimuth "minimum intrusion" technique which ALFALFA employs delivers high data quality and observing efficiency: with the exception of hardware failures, science data are acquired during ~ 97% of each assigned observing block and 99% exclusive of setup/shut down. Furthermore, the TOGS program has run commensally with ALFALFA since August 2005, with the observing burden for TOGS borne by the ALFALFA team. As of July 15, 2008, ~ 40% of the survey area has been fully mapped and sources have been extracted from Level II spectral data products (3-D cubes) covering about 25% of the total sky area. Five catalogs extracted from the Level II data have appeared in the refereed literature. SQL searchable databases and plotting tools are made public when their associated presentation papers are accepted for publication (as per VO requirement). To date, 20 papers based on ALFALFA have appeared in the refereed literature, and several others are submitted or in advanced stages of preparation. Numerous papers and posters have been presented at conferences; see: *http://egg.astro.cornell.edu/pubs.php.*

Team members have web access to preliminary, searchable source catalogs for the planning and execution of multiwavelength followup observations. Because ours is an open consortium, scientists motivated to undertake a specific science project are encouraged to join the ALFALFA team and submit a proposal to the ALFALFA Oversight Committee (OC). Upon approval of their proposed project by the OC, new members then gain access to the ALFALFA dataset in advance of its public release. This policy is stimulating a continuous increase in the number of ALFALFA-based projects and seeds multiwavelength observing programs using other facilities as well as numerical simulations; see: *http://egg.astro.cornell.edu/projects/projects.php.*

The ALFALFA IDL-based data reduction, signal extraction and ancillary software package has been exported to 20+ sites where it is in regular use by team members. Well-developed documentation, websites, and hands-on training in observation and reduction techniques are provided to new team members by ALFALFA experts. Numerous members of the ALFALFA team have spent time at Cornell to receive intensive training in the observing, data reduction and data analysis process; other communications include the use of telecons and visits by the Cornell experts to other sites.

A2010 observing: Drift scan data have been acquired during XXX separate observing sessions since February 2005. A well defined and well documented protocol of tasks and their assignments insures observing efficiency and data quality; See: *http://www.naic.edu/~a2010/whodoeswhat.htm.* Haynes oversees the sequence of observations. At all times, a trained ALFALFA observer oversees the observing sequence, including execution of the TOGS calibration before and after the A2010 time when TOGS calibration time is allocated. The observer is also responsible for maintaining a standard log file (made accessible to the TOGS, GALFACTS and P-ALFA teams) and performing regular data quality checks. At the end of the observing session, the observer updates the observing team web pages and starts a script which converts the FITS files to IDL structures. Later the same day, the "data monitor", a different person located at Cornell, checks the observer's notes, takes any required actions recommended by the observer, transfers the raw IDL files to Ithaca and updates the scheduling web pages. New datasets are calibrated, bandpass subtracted and spot checked the same day or within a few days of acquisition as an additional check on data quality. Further Level I processing is organized to generate datasets covering contiguous areas so that final 3-D grids can be produced.

In terms of efficiency, ALFALFA records data continuously, with an "open shutter" rate of 99%. About 5% of the allocated time is used for setup and telescope slew time; in practice, during another 5% of the time, the LST range is outside of the survey map area. Because time is often allocated in blocks shorter than optimal for our mapping strategy but for the convenience to the AO scheduler trying to accommodate multiple observing programs, the actual time allocation leads to some loss of optimal efficiency and coverage for the ALFALFA program. However, lost telescope time is minimal; only 9 full sessions have been totally lost due to hardware failures (2% of sessions).

• **Dataset and product status**: Processing of the data is proceeding according to schedule. Raw data in FITS format are converted to IDL and transferred to Cornell daily. Processing to Level I usually occurs within days to weeks using a standard pipeline in ALFALFA-IDL. A laborious part of Level I processing is the flagging of RFI, a necessary (unfortunately) and extremely beneficial exercise. Construction of final data products in some areas is limited by the incomplete coverage of datasets due to the spottiness of time allocation, but we are engaged in systematic reduction of selected, fully sampled areas. A few points are worthy of note:

- ALFALFA acquires data at a rate of about 1 GB/hour. Raw data is archived at Arecibo by NAIC. About 4 TB of Level I datasets (2-D) are currently housed at Cornell for quick access; about 2 TB of Level II datasets (3-D) are also housed at Cornell. Reduction status (both Level I and Level II) is available on the team-only website. If the skeptical review panel needs access to this site, it can be provided upon request. Priority in processing is given to completing Level I processing of datasets needed to yield full coverage of contiguous areas for gridding purposes and regular checks to insure data quality.
- Both Level I and Level II datasets are produced by numerous team members following a very strict protocol and after several extensive training sessions by a reduction "expert". Each Level I and Level II dataset is later checked for quality by a senior member of the team before being delivered into the archive. Final catalog production is also carried out by a senior individual, providing a second check. Haynes oversees the Level I process and Giovanelli, Level II.
- The construction of 3-D grids proceeds as datasets become complete. To minimize data transfer, all grids are produced at Cornell. Each grid represents a square of $2.4° \times 2.4°$ of sky, with contiguous grid centers separated from each other by 2°. Pointing corrections derived from the NVSS sources in the grids themselves are applied as part of the grid preparation process; since ALFALFA employs a drift scan technique, an entire strip of grids at the same declination and hence zenith angle is used to derive pointing corrections. As of 15Jul08, about 2000 grids have been generated and sources extracted from them, corresponding to 25% of the final survey dataset. Because of the need to maintain uniformity and high quality, source extraction is being undertaken only by a small group of experts trained and monitored by Giovanelli. Persons involved in signal extraction/catalog construction are required to spend several weeks working at Cornell on this task prior to working back at home. Both Giovanelli

and Haynes are involved in final catalog checkout to insure uniformity and quality control. See further discussion under **Issues of concern** below.

- Signal extraction within the 3-D datasets is performed using a Fourier domain technique (Saintonge 2007a) and makes use of confirmation in both polarizations, both passes and adjacent beams. Signals are categorized according to signal-to-noise ratio and coincidence with optical counterpart where applicable. Followup LBW observations have been undertaken to verify detection reliability schemes.
- Some ALFALFA projects require early access to the Level II data for purposes other than catalog construction; such datasets are available to team members upon request, within necessary limitations imposed by security and data transfer issues.

Issues of concern raised by the 2007 skeptical review: We repeat here discussion provided in our 2008 annual report; we are not sure whether these concerns remain.

The 2007 skeptical review committee rightfully raised concerns about the maintenance of standards for delivering uniform high quality data products. We share the committee's concerns. Our 2008 report emphasized the process we have put in place to train team members engaged in data processing, to have an expert oversee each step, and to introduce redundancy (multiple, different checks) is working. Level I processing is fundamentally more straightforward and accessible to individuals with lesser expertise; a larger number of individuals are engaged in this activity, but still each is trained by an "expert" and each dataset is checked (and feedback provided) before release into the Level I archive. The Level II processing, which includes final 3-D grid production, source extraction and catalog construction, is undertaken by fewer individuals who are fully vested in the outcome (e.g., graduate students who are pursuing ALFALFA catalog-related Ph.D. research and fully engaged team members), each of whom has participated in a several week "full immersion" training session with IDL-ALFALFA in Ithaca and has passed a set of quality standards overseen by Giovanelli. Giovanelli and Haynes run independent and distinct tests on the final catalog to insure uniformity of depth, parameter extraction and optical counterpart identification. We are confident that this attention to detail, definition and assignment of responsibility (albeit shared) and process to provide training and feedback is proving successful in maintaining ALFALFA data quality and homogeneity.

Appendix B: Undergraduate students engaged in ALFALFA research 2008-9.

George Mason University: (Faculty: Jessica Rosenberg)
- Lisa Horne '09 Physics
- Preston Zeh '10 Physics

Georgia Southern University: (Faculty: Sarah Higdon)
- Sara Ceran Physics 2009
- Josh Davidson Physics 2009
- Daniel Richey Physics 2009

Humboldt State University: (Faculty: David Kornreich)
- Tess Senty, Physics 2010
- Steven Margell Physics 2009

Indiana University, Wesleyan: (Faculty: John Salzer)
- Arthur Sugden, 2008 Astronomy
- Jessica Kellar, 2008 Astronomy
- Katie Derloshon, 2010 Asrtonomy

Lafayette College (Faculty: Lyle Hoffmann)
- Peiyuan Mao, 2011 Physics

Siena College: (Faculty: Rose Finn)
- Patricia Carroll '09 Physics
- Trevor Quirk, Physics, 2009
- Kristie Dangerfield, Physics, 2010
- Robert Carroll, Physics, 2011
- Danielle Seeley, Physics, 2011
- Erin O'Malley, Physics, 2012
- James Pater, Physics, 2012
- Nathan Levine, Physics, 2010
- Nicholas Opels, History, 2012

Skidmore College: (Faculty: Mary Odekon)
- Scott Manglitz '09 Physics
- Jake Turner '11 Physics
- Michael Kellar '10 Physics
- Paul Russell '11 Physics

Union College: (Faculty: Becky Koopmann)
- SreyNoch Chin, Mechanical Engineering/Physics 2013
- Schuyler Smith, high school
- Katelyn O'Brien, Physics 2011

University of Colorado: (Faculty: Jeremy Darling)
- Erin Macdonald 2009 Physics and Math

University of Wisconsin: (Faculty: Eric Wilcots)
- Melissa Jacquart 2011 Astronomy

Cornell University (Faculty: Martha Haynes)
- Lamarr Parsons, 2009, Astronomy
- Kim-Yen Nguyen, 2010, Astronomy
- Ben Ou-Yang, 2010, Astronomy
- Hong Xiao-Yu, 2011, Astronomy
- Katherine Hamren, 2011, Physics
- Jae Hwan Kang, 2012, Physics

Appendix C: Graduate students engaged in ALFALFA-based research

Cornell University: (Faculty: Riccardo Giovanelli and Martha Haynes)

- Amélie Saintonge, PhD 2007; now at MPIfAp, Munich
- Brian Kent, PhD 2008; now Jansky Fellow at NRAO
- Sabrina Stierwalt, PhD 2009; now postdoc at Caltech/Spitzer Science Center
- Ann Martin, 5th yr
- Betsey Adams, 3d yr
- Shan Huang, 3d yr
- Manolis Papastergis, 3d yr

Indiana University: (Faculty: Liese van Zee)

- Jayce Dowell, 5th yr

Max Planck Institute for Astrophysics: (Faculty: Guinevere Kauffmann)

- Silvia Fabello, 2nd yr

Royal Military College of Canada: (Faculty: Kristine Spekkens)

- Cameron Arsenault, MSc 2009

University of Barcelona: (Faculty: Josep-M. Solanes)

- MariCarmen Toribio, 4th yr

Universita di Milano/Bicocca: (Faculty: Peppo Gavazzi)

- Michele Fumagalli, MSc 2008; now in PhD program (UCSC)
- Silvia Fabello, Msc 2008; now in PhD program (MPA; see above)

University of Minnesota: (Faculty: Larry Rudnick)

- Damon Farnsworth 2nd yr

University of North Carolina: (Faculty: Sheila Kannappan)

- David Stark, 2nd yr

University of Tel-Aviv: (Faculty: Noah Brosch)

- Oded Spector, 3d yr

University of Wisconsin: (Faculty: Eric Wilcots)

- Kelley Hess 5th yr

Appendix D: Funding grants based on ALFALFA

NSF CAREER/NSERC equivalent grants:

- Rose Finn, Siena College
- Jessica Rosenberg, George Mason U.
- Kristine Spekkens, Royal Military College of Canada

Other ALFALFA related grants:

- Mary Crone Odekon (Skidmore College)
  Skidmore Schupf Scholar Fund, Summer 2009

- Josep-M. Solanes (U. of Barcelona)
  Programa Nacional de Astronomia y Astrofisica (Spain), Reference: AYA2007-60366

- Rebecca Koopmann (Union College), Sarah Higdon (Georgia Southern University) and Tom Balonek, (Colgate U.)
  NSF AST-0724918 ADVANCE PAID (Partnerships for Adaptation, Implementation, and Dissemination)
  NSF ALFALFA Undergraduate Team AST-0725267
  ALFALFA UAT Supplemental Award AST-090339
  grants supports ALFALFA participation of faculty and undergraduates at 15 institutions.

- Sarah Higdon, Georgia Southern University;
  - GALEX/NASA Cycle 5 PROPOSAL, GI5 051 "Star Formation In NGC 4532/DDO 137'S Tidal Dwarf Galaxies and 500 kpc Stream
  - NASA K-12 award Georgians Experience Astronomy Research in Schools

- Edvige Corbelli and Carlo Giovanardi (Oss. Astrofisico di Arcetri)
  INAF postdoctoral grant to support Marco Grossi

- John Salzer (Indiana University)
  year NSF grant: "Making Hay with ALFALFA" (funding for H-alpha imaging program)

- Martha Haynes, (Cornell University)
  Brinson Foundation Grant (continuing)
  GALEX/NASA Cycle 3, 4 and 5
  NSF/ALFALFA AST-0607007

- Riccardo Giovanelli (Cornell University)
  GALEX/NASA Cycle 3, 4 and 5
  NSF/ALFALFA AST-0607007