The Arecibo Galaxy Environments Survey (AGES)

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Abstract

In this Extragalactic ALFA consortium proposal we are requesting 2000 hours of observing time over a 4 year period. The survey is specifically designed to investigate various galactic environments to higher sensitivity, with better spatial, and velocity resolution than previous, fully sampled, 21cm multi-beam surveys. We have chosen specific objects in the nearby Universe upon which to centre our observations, but will also use the full depth of the survey to quantify the HI properties of more distant galaxies. Our science goals include: the HI mass function in different environments, the contribution of neutral gas to the baryonic mass density, the nature of and link between high velocity hydrogen clouds and dwarf galaxies, the identification of gaseous tidal features as signatures of galaxy interactions and mergers, the low column density extent of galaxies, a comparison with atomic hydrogen detected by QSO absorption lines, the identification of isolated neutral gas clouds, the spatial distribution and properties of HI-selected galaxies and comparisons with numerical models of galaxy formation.

1 Introduction

With the advent of 21cm multi-beam instruments on single dish radio telescopes, it has become possible to carry out fully sampled surveys over large areas of sky. The HI Parkes All Sky Survey (HIPASS) has completed a survey of the southern sky to a sensitivity of about 13 mJy per beam and a similar depth survey over a smaller area of sky is being undertaken by Jodrell Bank (HIJASS). These surveys have been used to construct the first large volume HI selected catalogues of galaxies (Koribalski et al., 2004, Meyer et al. 2004), identify extended HI structures and High Velocity Clouds (HVCs) in the Local Group (Putman et al., 2002; Putman et al., 2003)), place limits on the faint end of the HI mass function (Kilborn 2000; Zwaan et al., 2003), identify a population of gas rich galaxies (Minchin et al., 2003), place limits on the numbers of previously undetected HI clouds and extended HI features (Ryder et al., 2001; Davies et al., 2001; Ryan-Weber et al., 2004), measure the HI properties of cluster galaxies (Waugh et al., 2002; Davies et al., 2004) and measure the cosmic mass density of neutral gas (Zwaan et al., 2003). Although, these surveys have been extremely successful, they suffered from rather poor HI-mass sensitivity (a 5σ limit of $1.2 \times 10^8\ M_\odot$ for a 30 km s^{-1} velocity width source at the Virgo cluster distance of 16 Mpc), velocity resolution (≈ 18 km s^{-1}), and spatial resolution (≈ 15 arc min). They have, however, set a benchmark by which other surveys can and will be measured.

The ALFA instrument fitted to Arecibo now offers an opportunity to survey large areas of sky at improved sensitivity, with better velocity and spatial resolution. This in itself does not guarantee new science, but by utilising the unique properties of this instrument on the world's largest single-dish telescope, here we propose to carry out a survey that does probe a new and unique parameter space. The Arecibo Galaxy Environment Survey (AGES) is designed specifically to study in detail (low HI masses and column densities) the atomic hydrogen properties of different galactic environments. These environments range from apparent voids in the large scale structure of galaxies, to isolated spiral galaxies and their halos, to galaxy-rich regions associated with galaxy clusters and filamentry structures. Our intention is to explicitly investigate the HI mass function in each environment, to measure the spatial distribution of HI selected galaxies, to identify individual low mass and low column density objects and to compare our results with expectations derived from QSO absorption line studies and simulations of galaxy formation.

The Extragalactic ALFA consortium (EALFA) has been split between four separate surveys for which separate long term proposals will be submitted. The shallow Arecibo all sky survey (ALFALFA) will carry out a drift scan survey of the whole Arecibo sky. The Ultra-deep survey will carry out extremely long integrations of a small area. The Zone of Avoidance (ZOA) survey will concentrate on extra-galactic studies within the Galactic plane. AGES is designed to extend the integration times per point compared to the ALFALFA survey in order to look for lower mass and lower column-density objects in certain well defined environments.

The very nature of survey work, and particularly a rather deep survey like this, necessitates an extended period for successful completion. This requires both a commitment by NAIC to see the project through and a commitment by the proposers to provide direction and project management over an equivalent period of time. We believe that within EALFA we have put in place a large consortium of interested, enthusiastic scientists along with a co-ordinating committee that will lead this project to a successful conclusion. This commitment is to both the exploitation of scientific data and to the essential data reduction software and associated archiving facilities that are required to make the project a success.

2 Results from the precursor observations

In Nov/Dec 2004 we used approximately 80 hours of ALFA time to carry out precursor observations. We observed the nearby galaxy group centered on NGC628 (M74). The group lies at about 10 Mpc from us and so our calculations suggested that we should be able to reach a mass limit of $M_{HI} \approx 2 \times 10^6\ M_\odot$ (more than an order of magnitude better than HIPASS). NGC 628 together with its companions UGC1104, UGC1171, DDO13(UGC1176), UGCA20 and KDG10, and the peculiar spiral NGC660 (with its companions UGC1195 and UGC 1200) form a structure similar to the Local Group (Sharina et al., 1996). We carried out twenty 20 min scans (5^o) across each declination strip and combined five 12.6 arc min strips. Thus we covered an area of 5×1 sq deg with an integration time of 240s per point. At the distance of NGC628, 5^o is about 1 Mpc and each beam covers about 10 kpc. This strip is extended compared to the size of NGC628; our intention was to look not only at the galaxy but also its immediate environment. NGC628 is close enough that we are sensitive to low HI mass, but its velocity (657 km s^{-1}) is high enough to be well separated from local HI (HVCs have velocities of less than 150 km s^{-1} in the direction of NGC628). We have adapted and used the HIPASS data reduction software (see below) so that we can reduce ALFA data. In Fig 1. we show our results from an initial reduction and gridding of the data. The noise in the cube decreases as root t when more scans are added and from this we predict 0.5-1.0 mJy rms noise in a complete (300s per point) AGES data-cube. We have identified a new HI source in the group and are currently carrying out imaging to see if there is a faint optical counterpart (Faulkes Telescope). There is still an issue about the best scanning technique, which we address in the technical section.

In addition to the above multiple drift-scanning, we also carried out, as part of the precursor proposal, both a 'leapfrog' technique and ZOA observations. Both the 'Leapfrog' method and the ZOA observations are well suited to comensal observing with the pulsar group and we await the opportunity to start this mode of operation. This proposal is only for a continuation of our successful multiple drift scan observations.

3 Brief out-line of the survey

The AGES survey will concentrate on a number of environments situated at all RAs to provide observing opportunities at all times of the year. For most of our sources we have chosen an area (5x4 sq deg) which will correspond with an ALFALFA survey tile so that data from both surveys can be easily combined. The on source times are

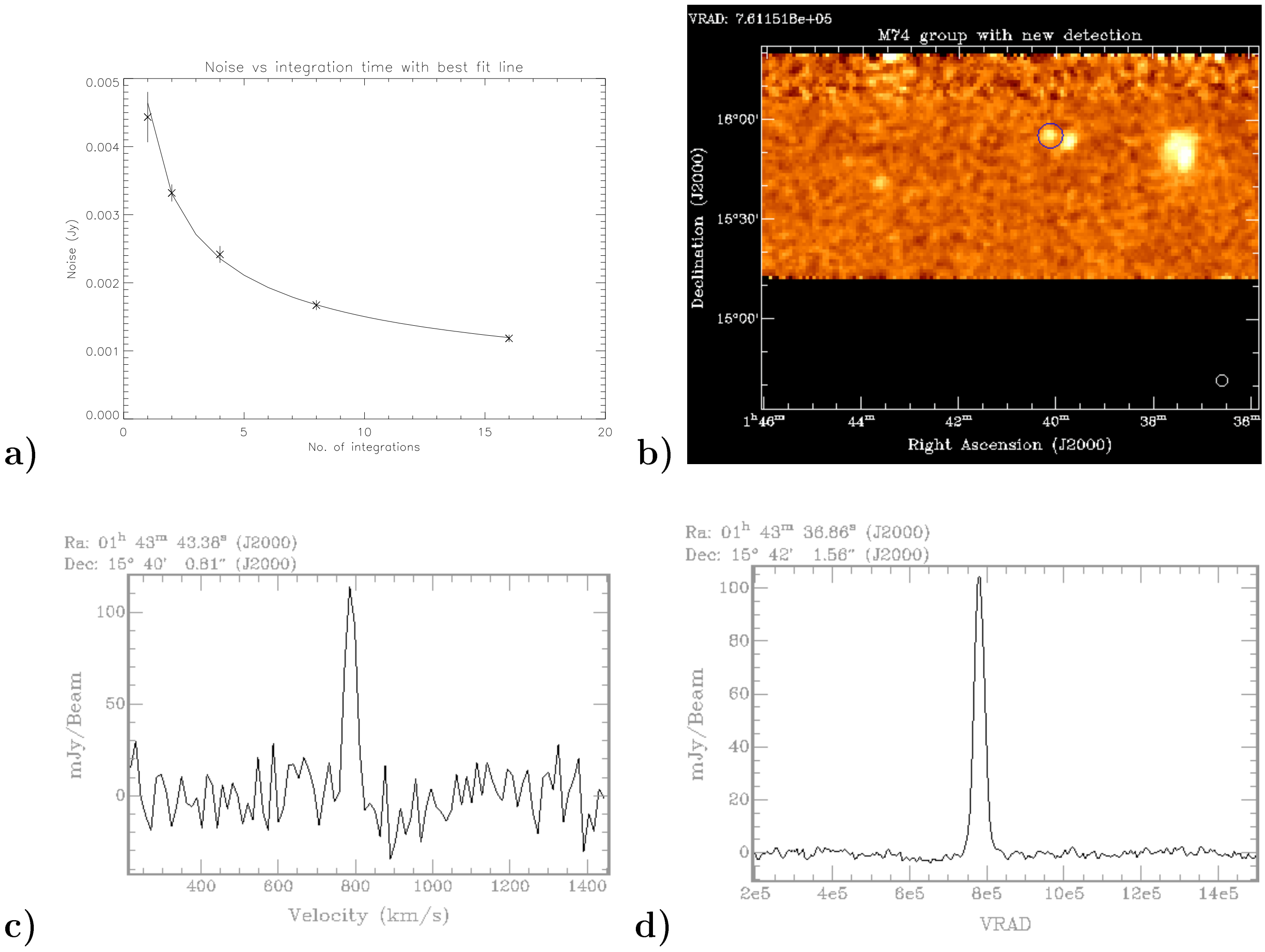

Figure 1: a) Graph to show how the rms noise decreases in our data cube as more scans are added. The line is that expected for noise $\propto t^{-1/2}$. b) A section of the data cube at a velocity of 761 km s^{-1}. The black circle marks the position of our new HI detection. In fig. 1c) and d) we compare HIPASS (left) and AGES (right) spectra of KDG10, a dwarf galaxy companion of M74. The data can be directly compared because KDG10 is not resolved by either the Arecibo or Parkes beams. The agreement is excellent showing that our calibration and data reduction methods are sound. Note the substantial reduction of noise in the AGES data which in this case is the addition of 16 scans.

300 sec per point which should give 0.5-1 mJy rms noise in the combined co-added data (see above). This rms noise compares with about 14 mJy for the HIPASS survey and about 2.5-5 mJy for the ALFALFA survey. As a benchmark, the above integration time should enable us to reach an HI mass limit of about 5×10^6 $M_\odot$ at the distance of the Virgo cluster (16 Mpc). The survey can be divided into two parts. Each survey region is specifically positioned to detect, measure and map HI in a specific, nearby galactic environment. Each survey region obviously samples a large, more distant volume (to $\approx 18,000$ km s^{-1}) that will be used to study the HI-mass function and the HI properties of galaxies in more detail.

Summary of science issues

1. The HI mass function in different environments - around large galaxies, in groups, clusters and beyond the Local Supercluster - comparison with galaxy evolution models.
2. Given the excellent correlation between star-formation-rate and 20cm continuum emission, we will use the continuum emission to measure the star formation rates of a large number of galaxies selected by their gaseous rather than their optical or far infrared properties.
3. The contribution of neutral gas to the baryonic mass density - the 'missing' baryonic matter problem.
4. The nature of and possible link between HVCs and dwarf galaxies - a possible solution of the CDM sub-structure problem ?
5. The identification of gaseous tidal features as signatures of galaxy interactions and mergers - the importance of mergers as a mechanism for the assembly of galaxies, gas removal mechanisms in clusters and groups.
6. The velocity dispersions of galaxies in groups and clusters - dark matter.
7. The dynamical masses of galaxies - galaxy rotation curves - dark matter.
8. The low-column-density extent of large galaxies - ionisation by the metagalactic radiation field.
9. The identification of isolated neutral gas clouds - remnants or precursors of the galaxy formation process ?
10. A comparison of the atomic hydrogen detected by QSO-absorption-line and 21cm observations - consistency between different observations that measure the same thing.
11. The spatial distribution of HI selected galaxies.
12. A comparison with numerical models of galaxy formation - providing input and tests of the simulations.
13. Serendipitous findings - with a survey like this, covering large areas to low mass-limits and column-densities, we might hope to make new and unexpected discoveries.

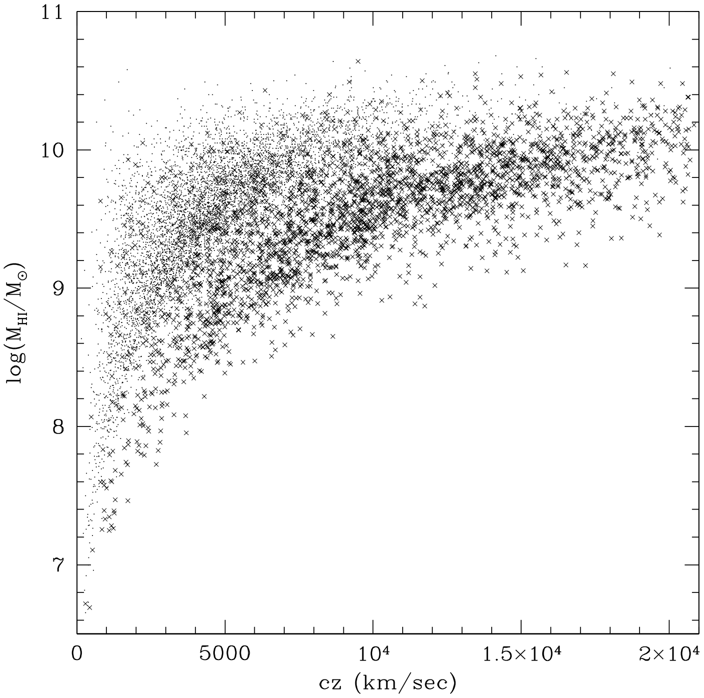

Figure 2: Masses of detected HI sources against their redshift distance for the 12s integration ALFALFA survey (dots) and the proposed 300s integration AGES survey (crosses).

4 The Survey Fields

1. **The AGES Volume (AGESV)** - This part of the survey will make use of all the survey fields described below to 'observe' the volume beyond the chosen nearby objects (the velocity range is -1800 - 18,000 km s^{-1} a little less than twice that of HIPASS/HIJASS). We will sample the galaxy population in general and measure the the HI mass function beyond the Local Supercluster. The 'universal' HI mass function remains poorly characterized based on current HI surveys. Even though the Parkes survey (Zwaan et al. 2003) has improved the statistical uncertainties, they find significant and systematic differences in the mass function in different quadrants of the sky, even for sources with HI masses up to 10^9 $M_\odot$. Similarly, Rosenberg & Schneider (2002) found significant differences in the quadrant of the sky containing Virgo versus the rest of the Arecibo sky. The effects of cosmic variance are still not well quantified, and the largest surveys to date, and even surveys like ALFALFA, cannot explore the mass function beyond the Local Supercluster. The best estimate of the source of damped Ly-alpha absorbers is that they arise mostly from sources in the neighborhood of 10^9 $M_\odot$ galaxies (Rosenberg & Schneider, 2003). Thus connecting our understanding of the evolution of these absorbers with the nearby population of HI emitters requires a better understanding of the HI mass function and its variance. It is important therefore that we carry out a deeper survey to determine if the local environment is typical. Figure 2 illustrates the difference between a large shallow survey (ALFALFA) and a medium deep survey (AGES) by plotting the masses of simulated HI sources against their redshift distance. It is based on a simulation using the Parkes HI mass function ($\alpha = -1.3$), and includes realistic distributions

of galaxy rotation speeds, inclinations, detection thresholds, and completeness rolloff. The model successfully reproduces the distribution of characterisitics and detection rates found by Rosenberg & Schneider, but it has been modified here to simulate the sensitivies and coverages that we might expect with approximately 1000 hours of observing in:

(a) the 12s ALFALFA-type driftscan mode (which is quite similar to Rosenberg & Schneider) shown by simple points in the plot.

(b) the proposed AGES observations with 25 times longer integrations per point and 25 times less area of the sky covered, shown by x's in the plot.

In the shallow survey, nearly 7000 sources are detected, while the deeper survey detects nearly 3000 sources. Our ability to characterize the HI mass function at any distance can be estimated by looking at vertical cuts through the distribution of points in this diagram. Note that the choice of 12 s and 5 min integrations complement each other quite well in terms of neither leaving a significant gap in mass coverage at any redshift nor in overlapping each other so heavily that we give up sensitivity to lower mass sources. The shallow survey detects many more lower-mass sources, but they are also nearby. It can characterize the HI mass function for sources down to about $10^{8.5}$ $M_{\odot}$ within the Local Supercluster (out to $cz \approx 2000$ km s^{-1}). Complemented with the AGES survey, we are able to characterize the population within this distance down to about $10^{7.8}$ $M_{\odot}$. Likewise, the shallow survey can provide good statistics on the mass function near 10^{9} $M_{\odot}$ out to $cz \approx 3000$ km s^{-1}, but the AGES survey carries this out to about 7000 km s^{-1} - the distance of the Coma Cluster and beyond the redshift of the Great Attractor. This will provide us with a much more complete understanding of the mass function and its possible variations outside of our nearby environment, and allow us to tie our results more clearly to the damped Ly-alpha absorber results. Total sky coverage is 220 sq deg which our simulations indicate should produce a catalogue of some 4800 galaxies. The entire HIPASS catalogue contains 4315 HI selected galaxies (Meyer et al., 2004).

2. **The Virgo Cluster (AGESVC)** - We have selected two regions of the Virgo cluster to make a comparison of the HI properties of cluster galaxies with those in the field. Both regions avoid the inner 1 deg of the cluster to reduce interference by the large continum source M87 and because previous observations indicate very little HI within the cluster core (Davies et al., 2004). The first region is the 5 × 4 sq deg area centred on RA=12 21 00 Dec=17 00 00 (J2000), which coincides with the area observed in the deep Jodrell Bank multi-beam (HIJASSVIRGO) survey of Davies et al. (2004) (see also Gavazzi et al., 2005). The AGES survey will reach an rms noise level about a factor of four lower than the HIJASSVIRGO data and will benefit from better spatial resolution (3' compared to 12') and velocity resolution (3 compared to 18 km s^{-1}). With these observations we want to make an important comparison between what can be found in an Arecibo compared to a Jodrell Bank (Parkes) survey and also use it to extrapolate what might be found if we were able to go deeeper still. The selected region includes areas of the M and N clouds which are thought to be infalling clouds from behind Virgo and may be at twice the distance of M87 (Binggeli et al., 1987). It will be interesting to see how gas-rich the clouds are compared to galaxies in the main part of the cluster. The second region is an East-West 5 × 1 sq deg strip centered on RA=12 48 00 Dec=11 36 00 (J2000). This strip again avoids the central 1 deg of the cluster, but now extends

radially outwards to the cluster edge, so that we can look for changes in the galaxy properties with cluster radius. This strip extends through the galaxy grouping known as subcluster A associated with M87. These observations will be compared with models of how cluster environment affects galaxy evolution (tidal, ram pressure stripping etc.). We will also be able to search for low mass galaxy companions or cluster dwarfs and for unidentified HI clouds. The HIJASSVIRGO survey of Davies et al., (2004), with the help of Arecibo follow up observations, has already discovered a putative dark galaxy (Minchin et al., 2005). We will look to see how the cluster baryonic material is divided between its individual components (stars, x-ray gas, neutral gas) and compare this with field galaxies. With regard to AGESV the Virgo cluster extends, because of its large velocity dispersion, to about 3000 km s^{-1}. There are very few catalogued galaxies then until 6000 km s^{-1} when material associated with the large grouping of galaxies at about the redshift of Coma become visible (also A1541). Little is known about galaxies beyond 8000 km s^{-1} over this region. **On-source time 200 hours**.

3. **The Local Void (AGESLV)** - we have selected a field at the center of the Local Void area 5×4 sq deg centered on RA=18 38 00 Dec=18 00 00 (J2000). We will search for HI signatures that might be associated with very low surface brightness galaxies or with HI clouds devoid of stars. We will compare the properties of any galaxies detected with those in more dense environments. The Local Void extends certainly to beyond 3000 km s^{-1} and there is no previously well defined structure out to 10000 km s^{-1}. **On-source time 160 hours**.

4. **M33 and the Perseus-Pisces filament (AGES33PP)** - a field around M33 of area 5×4 sq deg centred on RA=1 34 00 Dec=30 40 00 (J2000). The aim is to map in detail the environment of M33 to search for tidal bridges, HVCs etc. that are signatures of diffuse hydrogen in the Local Group. M33 will occupy about 1 sq deg at the centre of our field. At the distance of M33, an Arecibo beam will span a region of about 0.6 kpc providing good spatial resolution. The HI mass sensitivity will be as low as $2 \times 10^4\ M_\odot$. AGESV will pick up the Perseus-Pisces filament at about 4000-6000 km s^{-1}. **On-source time 160 hours**.

5. **The cluster A1367 (AGES1367)** - A1367 is a spiral-rich, dynamically young cluster at a velocity of about 6500 km s^{-1}. It appears to have a substantial intra-cluster medium as witnessed by observations of ram pressure stripping and x-ray emission (Gavazzi et al., 2001, Sun and Murray, 2002). The whole cluster will just about fill the 5×4 sq deg area to be centred on RA=11 44 00 Dec=19 50 00 (J2000). Given the morphology of the cluster one might expect detections and hopefully new objects that are more prominent in HI than at other wavelengths. The HI-mass senitivity at this distance drops to $2 \times 10^8\ M_\odot$. With regard to AGESV there is little known structure in front of or behind A1367. **On-source time 160 hours**.

6. **The Leo I group (AGESLEO)** - we will survey a 5×4 sq deg area of this group which lies at about 1000 km s^{-1}, position centred on RA=10 45 00 Dec=11 48 00 (J2000). The group is of particular interest because of the relatively large number of early-type galaxies (NGC3377, NGC3379) and will make a good comparison with spiral-rich groups. Previous HI work on Leo I is reported in Buckley et al., (2003); but we will have a sensitivity better by about a factor of 10 in HI mass. For

AGESV there are other galaxy structures that appear at about 6000 km s^{-1}. **On-source time 160 hours**.

7. **The NGC7448 group (AGES7448)** - NGC7448 is a Sbc spiral galaxy with a number of late and early type companions making a good contrast with the Leo I group. NGC7448 has a velocity of 2200 km s^{-1} and we will survey an area of 5×4 sq deg (about a radius of 1 Mpc from the central galaxy) centred at position RA=23 00 00 Dec=15 59 00 (J2000). For AGESV this region looks through the Pegasus void at around 4000 km s^{-1} and should then pick up galaxies associated with Cetus between 7 and 8000 km s^{-1}. **On source time 160 hours**.

8. **The NGC3193 group (AGES3193)** - NGC3193, in contrast to NGC7448, is an elliptical galaxy and there are another 9 known group members all part of a well defined galaxy filament. NGC3193 has a velocity of 1362 km s^{-1} and we will survey an area of 5×4 sq deg centred at position RA=10 03 00 Dec=21 53 00 (J2000). For AGESV this region appears pretty much devoid of galaxies until about 6000 km s^{-1} when it picks up galaxies associated with the extended distribution of galaxies about Coma and A1367. **On-source time 160 hours**.

9. **Individual galaxies (AGESGAL)** - A comparison of pairs or isolated galaxies with the principle galaxy either of early or late type.
   (a) NGC6555 (type=Sc, face-on) - RA=18 06 00 Dec=17 30 00 (J2000), v=2225 km s^{-1}, pair with NGC6548.
   (b) NGC2577 (type=SO) - RA=08 24 00 Dec=22 30 00 (J2000), v=2057 km s^{-1}, pair with UGC4375.
   (c) NGC7332 (type=SOpec) - RA=22 36 00 Dec=23 48 00 (J2000), v=375 km s^{-1}, pair with NGC7339.
   (d) UGC2082 (type=Sc, edge-on) - RA=02 36 00 Dec=25 48 00 (J2000), v=696 km s^{-1}, very isolated.
   (e) NGC1156 (type=Irr) - RA=03 00 00 Dec=25 12 00 (J2000), v=375 km s^{-1}, very isolated.

   Each object beyond 1000 km s^{-1} will be centred on a 5×4 sq deg region, those below 1000 km s^{-1} will be centred on a 2.5×2 sq deg region. **On-source time 440 hours**.

The above amounts to a total requested **on source time of 1600 hours** over a four year period. This is just over 1 hour per day. The data cubes will gradually be built up over the four year period to full sensitivity.

5 Technical issues and survey techniques

Survey Strategy - AGES will be carried out using the fixed-azimuth drift scan mode, as in the precursor observations. The details of our scan strategy have been revised in the light of those observations; we

Field	RA(J2000)	Dec(J2000)	Area (sq deg)	Time (hours)
AGES33PP	01 34 00	30 40 00	20.0	160
AGESGAL2082	02 36 00	25 48 00	5.0	40
AGESGAL1156[1]	03 00 00	25 12 00	5.0	40
AGESGAL2577	08 24 00	22 30 00	20.0	160
AGES3193	10 03 00	21 53 00	20.0	160
AGESLEO	10 45 00	11 48 00	20.0	160
AGES1367	11 44 00	19 50 00	20.0	160
AGESVC1	12 21 00	17 00 00	20.0	160
AGESVC2	12 48 00	11 36 00	5.0	40
AGESGAL6555	18 06 00	17 30 00	20.0	160
AGESLV	18 38 00	18 00 00	20.0	160
AGESGAL7332	22 36 00	23 48 00	5.0	40
AGES7448	23 00 00	15 59 00	20.0	160
			On source time	1600
			25% overhead (see below)	400
			Total time requested	**2000**

Table 1: Summary of observations requested. [1] To be observed over an extended period in the first year (see below).

now plan to make a number of scans at three different azimuths (normally expected to be $\approx$ 30 minutes pre-transit, at transit, and $\approx$ 30 minutes post-transit) with each scan being offset by 1.5 arcmin from the previous. Using this strategy, 40 scans at each azimuth (so 120 in total) will cover a degree of declination. With each scan being 20 minutes long, a full-depth survey of a 5×4 degree area should take 160 hours on-source, with around 40 hours (25%) of overheads (5 minutes at start-up and 5 minutes between each of the azimuth scans, giving 15 minutes for each set of three azimuths). The AGES scan strategy is designed so that every beam makes its own Nyquist-sampled map of the sky at each of three azimuths. This has the advantage that every beam contributes to every position in the final map, so that the asymmetric sidelobes are removed through the median filtering process (as is done for both the HIPASS and HIJASS surveys). Any remaining sidelobes should be both symmetrical around the beam, or they would have been removed, and consistent across the map, as all areas have the same coverage. This will make it possible to carry out cleaning on the final map, if necessary, using continuum sources within the map itself. This strategy will also make it possible for the data to be cleaned on a beam-by-beam basis at a later date, if necessary, by mapping the individual beams using strong continuum sources. This is not part of the AGES plan, but the possibility of this usage, particularly for in-depth investigations of resolved sources, will remain as part of the AGES legacy. The NGC2903 group is obtaining beam maps over a range of azimuth and these will be available to us, if needed.

Calibration - The standard gain curves for the ALFA beams, as provided by Arecibo, will be used to calibrate our observations. To ensure no system changes have increased (or decreased) the telescope

SEFD, we will take a cross scan on 3-4 standard calibrators, located at the same right ascension as our observations, at the beginning and end of each night's observations.

Software development - Our preferred option for the precursor observations was to adapt the HIPASS software (LIVEDATA and GRIDZILLA operating as part of AIPS++). To this end we put together an AGES computing group (O'Neil, de Blok, Minchin, Auld, Kilborn) who have experience of writing, installing and using the AIPS++/HIPASS software. This has proved to be an extremely successful option (as witnessed by the results of our precursor run described earlier). Much progress is being made with the help of Mark Calabretta, one of the originators of the software. The LIVEDATA/GRIDZILLA software takes the CIMAFITS format data and carries out the necessary band and flux calibrations and then reassembles the data into a RA-Dec-velocity data cube. Our intention is to continue to use the HIPASS software for our data reduction - this software is already up and running.

Archiving the data - We will create an archive with web access at the Arecibo observatory. The archive will not be large as it will only consist of 200 sq degs of data split into 13 data cubes, with a total database size of about 15 Gbyte. The cubes will be continuously up-dated as new data is obtained and added, so the cubes will always be available at the current sensitivity. Thus at the end of the 4 year period the survey cubes will have reached their full sensitivity. Each cube will be separately downloadable in a standard fits format for analysis by either private or standard HIPASS/AIPS++ format analysis packages. We hope to provide (see for example the HIPASS web page) software for the extraction of spectra. The raw data will be obtainable from the Arecibo archive.

Project management - The project will be managed on a day-to-day basis by the PI (Davies) in consultation with consortium members. Overall strategy and synergy with the other EALFA projects will be the responsiblity of the EALFA coordinating committee (Davies, Giovanelli, Henning, Irwin, Freudling). Data reduction will be the responsibility of the computing group led by O'Neil. Organisation and training of observers during observing periods will be the responsibility of Davies. We have a large number of experienced and willing observers to draw from already; Auld, Davies, Giovanelli, Haynes, Henning, Linder, Momjian, Muller, Minchin, Putman, Sabatini, Schneider and van Driel all observed during the precursor observations.

Other data - A crucial part of the science is the ability to associate or not HI sources with optical counterparts. For this reason our choice of fields has also been influenced by the availability of optical and near-infrared data. The AGESVC fields have already been observed in the B and I bands (INTWFC) and the 5 × 1 sq deg strip will be observed at H_α in March 2005. Extensive data on Virgo cluster and A1367 galaxies can be found in 'Goldmine' (Gavazzi et al., 2003). The UKIRT Infrared Deep Sky Survey (UKIDDS) will cover the Virgo cluster and Leo I fields (Davies is a consortium member) in J, H, K (about 5 magnitudes fainter than 2MASS) with the new Wide Field Camera (UKIRTWFC) from April 2005. These Virgo fields along with A1367 are also covered by the GALEX UV observations (Boselli and Gavazzi). We will be applying for time to image the other fields with the INTWFC and UKIRTWFC. We will also be proposing to use the VLT Survey Telescope (VST) to carry out optical imaging of our fields (deadline 15th Feb). With consortium members Baes (ESO), Putman (Michigan), Kilborn (Melbourne), Brosch (Wise Observatory), van Driel (Meudon) and Karachentsev (Moscow) we will be applying for time on the ESO 2.2m, Magellan and Kitt Peak, Siding Spring 2.2m, WiseObs, CFHT and Russian 6.0m telescopes respectively. Individual targets, once identified may be followed up with larger 8m class optical telescopes and in the radio at Greenbank (O'Neil), Nancay (van Driel) and the VLA.

The first year - The first year's observations are crucial to demonstrate the success of our project. During this time we expect to make about a quarter of our observations and to report back to the observatory about the progress made. As the first year is a period over which we need to develop new software and then demonstrate the succes of our observing strategy and data reduction we ask to observe one field (AGES1156) to somewhat larger depth than normal in one year so that we can test the techniques.

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