National Astronomy and Ionosphere Center
Arecibo Observatory

Cornell University, Ithaca, New York 14853
Arecibo, Puerto Rico 00612

The following report covers the period July, 2002 through June, 2003.

1. FACILITIES

The Arecibo Observatory is the primary research facility of the National Astronomy and Ionosphere Center (NAIC). The NAIC is operated as a visitor-oriented national research center by Cornell University under a cooperative agreement with the National Science Foundation (NSF). Partial support for the planetary radar program is provided by the National Aeronautics and Space Administration (NASA). Typically about 85% of the available observing time has gone to astronomical research programs, the remaining 15% going to research programs in atmospheric sciences (aeronomy).

The Arecibo Observatory is located about 12 km south of Arecibo, a city on the north coast of Puerto Rico about 80 km west of San Juan. The principle instrument of the observatory is a 305-m-diameter spherical radio reflector antenna. Radio sources can be tracked within 20 degrees of the zenith using moveable feeds suspended above the stationary reflector. The observatory latitude of $18°21'$N gives a declination coverage of about $-1°39'$ to $+38°21'$. Depending upon their declinations, celestial objects may be within view at Arecibo for up to 2 h 40 m each day.

Besides the main antenna, the observatory maintains an optical facility for passive airglow and lidar observations. This facility can be used independently or in conjunction with ionospheric radar experiments using the main antenna.

Operational support at Arecibo includes a scientific staff, an electronic maintenance and development shop, mechanical engineering and maintenance services, computing facilities, technical library, living accomodations for visiting scientists, and a cafeteria. Additional support is provided by the NAIC staff at Cornell University in Ithaca, New York, where some administrative and business functions, a small electronics development group, and a small scientific group are located.

2. INSTRUMENTATION

Most of the telescope's receivers are mounted on a Gregorian subreflector system. Receiving systems currently available on the Gregorian include 327-MHz, 430-MHz, 610-MHz, L-band (consisting of two separate systems: an ''L-narrow'' receiver for 1.37–1.45 GHz and an ''L-wide'' receiver for 1.15–1.73 GHz), S-band (consisting of three separate systems: an ''S-low'' receiver for 1.8–3.1 GHz, an ''S-radar'' receiver for 2.33–2.43 GHz, and an ''S-high'' receiver for 3.0–4.0 GHz), C-band (consisting of two separate systems: a ''C'' receiver for 3.85–6.05 GHz and a ''C-high'' receiver for 6.0–8.0 GHz), and X-band (8.0–10.0 GHz). The current sensitivities for these Gregorian systems are 10.5 K/Jy (327 MHz), 11 K/Jy (430 MHz), 10.5 K/Jy (610 MHz), 10.5 K/Jy (L-band), 9–10 K/Jy (S-band), 7–8 K/Jy (C-band), and 4.3 K/Jy (X-band). In addition to the Gregorian systems, there is the original 430-MHz ''Carriage House'' line feed (18 K/Jy), which is used both for passive radio astronomy and as the feed for a 430-MHz pulsed radar system (150 kW average power). This radar is the prime instrument for ionospheric incoherent scatter experiments, but can also be used for planetary radar observations. A 430-MHz transmitting capability is also available on the Gregorian for use in dual-beam ionospheric radar observations. The prime instrument for planetary radar observations is the S-band (2380 MHz) radar installed on the Gregorian. This radar is a CW (non-pulsed) system with 1 MW transmitted power and a phase-coding capability for delay-Doppler observations. A third (47 MHz) radar system is also available on the Carriage House. More details and updates on system specifications and availability can be accessed on the observatory Web site (www.naic.edu).

A network of VMEbus single-board computers running the Wind River Systems VxWorks realtime OS kernel is used to control: telescope pointing, including active platform stabilization; receiver tuning and front-end setup for systems in the Gregorian dome; timing and sequencing of arbitrarily complex observing modes; and backend setup and data recording. A second network of Intel CPU-based PCs running the Linux OS is used to control the 4x100 MHz spectrometer backend. Data acquisition backends include: (1) a general-purpose A/D system capable of sampling four analog channels at up to 10-MHz rates with resolutions of 1 to 12 bits per sample per channel; (2) a 16384-channel Spectral Line Correlator with four RF sub-bands independently bandwidth-adjustable from 195-kHz to 50-MHz; (3) a 50-MHz Radar Decoder; (4) a 4x100-MHz Pulsar Spectrometer with fast dump and on-line pulse folding capability; (5) a 10-MHz digital receiver with built-in FIR filters for radar applications; and (6) a 20-MHz 8-bit portable fast sampler with integrated high-speed data recorder. An S2 VLBI recorder and a Mark 4/VLBA system are available and operated as semi-autonomous backends. A remote observing capability for standard observing modes is supported by the user interface (CIMA).

Data can be recorded, depending on application requirements, on (1) fixed disk for access over the local area network, (2) 8 mm tape (Exabyte formats), (3) 1/2-inch Digital Linear Tape (Quantum DLT7000/8000/SDLT formats), or (4) optical Compact Disc media.

The data reduction network consists of: over fifty CPUs, including 64-bit SPARC-based workstations, 32-bit Intel x86-based PCs, and servers; over 5 TBytes of disk; and several 8 mm and 4 mm helical scan tape drives and DLT tape drives for data backup and archiving. Data reduction software includes the commercial packages IDL from Research Systems and MATLAB from The Math Works, as well as public-domain packages like ANALYZ, AIPS, IRAF, CLASS and AIPS++. The Observatory is connected to the Internet and Internet2 networks via a 155-Mbps optical link shared with the University of Puerto Rico.

3. OBSERVING PROPOSALS

The Arecibo Observatory welcomes and encourages research projects by qualified scientists from other institutions. Proposals are evaluated on a trimester basis, with submission deadlines of February 1, June 1, and October 1 of any given year. The normal scheduling window for a proposal begins four months after the corresponding deadline. All proposals are evaluated by anonymous referees outside of NAIC. A complete explanation of proposal submission and evaluation procedures can be found on the observatory Web site (www.naic.edu). Electronic proposal submission is preferred. The body of the proposal (a narrative giving the scientific and technical justification) should be e-mailed as a Postscript file to proposal@naic.edu. The proposer must also submit a separate cover sheet, preferably using our Web-based form. Those proposers who cannot submit electronically, or who cannot provide a Postscript version of the body, may send their proposals to: Director, Arecibo Observatory, HC3 Box 53995, Arecibo, PR 00612.

Those wishing to include Arecibo in their VLBI observations should submit proposals directly to the VLBA, EVN, or Global networks as usual, rather than to Arecibo.

4. STAFF

The NAIC scientific staff is located in both Arecibo, Puerto Rico and on the Cornell campus in Ithaca, New York. The Director of NAIC, Dr. Robert L. Brown, is based in Ithaca.

The observatory's Director of Operations, Dr. Sixto A. González, is based in Arecibo. NAIC-affiliated scientists and their areas of specialization are listed below.

4.1 Arecibo Staff

D. R. Altschuler - *Extragalactic Astronomy*
N. Aponte - *Ionosphere Studies*
A. A. Deshpande - *Pulsars, Interstellar Medium*
P. C. Freire - *Pulsars*
J. S. Friedman - *Optical Obs. of Ionosphere*
T. Ghosh - *VLBI, AGNs, ISS*
S. A. González - *Ionospheric Radar*
J. K. Harmon - *Planetary Radar, Solar Wind*
E. S. Howell - *Asteroid and Comet Studies*
D. Janches - *Ionosphere and Meteor Studies*
M. E. Lebrón - *Galactic Radio Astronomy*
B. M. Lewis - *Normal Galaxies, OH/IR Stars*
E. Momjian - *Galaxies, VLBI*
E. Muller - *Galaxies, Spectral Lines*
M. C. Nolan - *Planetary Radar, Asteroids*
S. Raizada - *Atmospheric Sciences, Lidar*
C. J. Salter - *Gal. Continuum, AGNs, VLBI*
M. P. Sulzer - *Ionospheric Radar*
C. A. Tepley - *Airglow, Lidar, Ionosphere*
C. R. Wilford - *Ionosphere Studies*
P. Hofner - *Molecular Lines*
C. A. Pantoja - *Extragalactic Astronomy*

4.2 Cornell Staff

D. B. Campbell - *Planetary Radar*
J. M. Cordes - *Pulsars, Interstellar Medium*
D. T. Farley - *Ionospheric Studies*
R. Giovanelli - *Extragalactic and Galactic Lines*
P. F. Goldsmith - *Molecular Clouds, Star Form.*
M. P. Haynes - *Galaxies and Clusters*
D. Hysell - *Ionospheric Studies*
M. C. Kelley - *Ionospheric Studies*
Y. Terzian - *Planetary Nebulae, ISM*
L. Baker - *Res. Support Spec. (Technical)*
G. Cortes - *Sr. Res. Assoc. (Technical)*

4.3 Summer Student Program

The Observatory conducts a Summer Student Program in astronomy and atmospheric sciences. For this program a small number of undergraduate and graduate students are chosen to spend the summer at Arecibo engaged in research programs under the supervision of staff scientists. Applications for the Summer Student Program should be submitted to NAIC by early February. The NAIC summer students for 2003 were:

G. Alvey, *U. Illinois*
N. Echevarría, *U. Puerto Rico*
J. Hodge, *Cal Poly*
M. Jouteux, *EUS, Lyon, France*
A. Mott, *Arizona St.*
C. Neish, *U. British Columbia*
R. Nikoukar, *U. Illinois*
M. Phillips, *U. Colorado*
K. Reilly, *New College of Florida*
E. Schmidt, *Carthage College*
C. Wheeler, *U. Akron*

5. COMMITTEES

5.1 AU&SAC Committee

The Arecibo Users and Scientific Advisory Committee (AUSAC) meets annually in Puerto Rico to advise the NAIC on the future needs for instrumentation and facilities. The current members are:

J. R. Fisher, *NRAO-Greenbank*
R. B. Kerr, *Scientific Solutions, Inc.*
L. A. Magnani, *U. Georgia*
J.-L. Margot, *Caltech*
J. M. Mathews, *Penn. St.*
I. H. Stairs, *U. British Columbia*
D. R. Stinebring, *Oberlin College*
H. A. Wootten, *NRAO-Charlottesville*

5.2 NAIC-VC Committee

The National Astronomy and Ionosphere Center Visiting Committee (NAIC-VC), appointed by Cornell to review the management and research programs of the Observatory, normally meets once a year. The current members are:

H. Carlson, *AFOSR*
J. M. Dickey, *U. Minnesota*
W. M. Goss, *NRAO*
R. J. Hanisch, *STScI*
J. Kelly, *SRI*
J. M. Rankin, *U. Vermont*
M. J. Reid, *Harvard-Smithsonian CFA*
F. P. Schloerb, *FCRAO*
H. A. Zebker, *Stanford*

6. PROGRAM HIGHLIGHTS

In this section we summarize some of the highlights of the science done in the past year by visiting scientists and observatory staff as part of formal, refereed observing proposals to NAIC. Here, as in previous years, we do not cover atmospheric science programs, which are outside the purview of this report.

6.1 Spectral Line Radio Astronomy

Bolatto, Simon, Robishaw (Berkeley), and Walter (NRAO) completed an observational program to study H I in the Leo Triplet, one of the nearest strongly interacting groups of galaxies. They used the new GUI on-the-fly mapping routines to construct a sensitive, Nyquist-sampled map covering an area of more than 3 square degrees, and encompassing the entire Triplet (NGC3623, NGC3627, NGC3628) plus the dramatic tidal features associated with NGC3628. Their future plans include complementing the Arecibo data with VLA and BIMA observations which will be used to model the Triplet interaction and the creation of tidal dwarf galaxies, and studying the formation of molecular clouds in this environment.

Hoffman (Lafayette) and Salpeter (Cornell) mapped H I in the fields of four low column density sources at velocities appropriate to High Velocity Clouds (HVCs) identified with the Green Bank 140-ft by Lockman *et al.* All were found to be quite clumpy on the scale of the Arecibo beam, much like the mini-HVCs they had found earlier. They have now indentified a grand total of 13 mini-HVCs. The implications of these low central column densities for ionization mechanisms (photo and collisional), for Lyα and other absorption lines in quasar and AGN spectra, and for the HVC distance controversy remain to be determined.

Balkowski, Cayatte, van Driel (Paris Obs., France), Hernández, O'Neil (NAIC), Duc (CEA, Saclay, France), Dickey (Minnesota), Iglesias-Páramo (Lab. d'Astrophys. de Marseille, France), Vílchez (IAA, Spain), and Thuan (Virginia) made an H I line search of a dozen H I clouds in the Hercules Cluster ($z \sim 11{,}000$ km/s) without optical counterparts on the Palomar Sky Survey. These clouds had been reported as tentative detections in the 1997 VLA H I survey of the cluster by Dickey. Subsequent CCD photometry by this team has shown faint optical counterparts of two of the reported clouds, whose VLA H I detections are now reconfirmed at Arecibo. Although the Arecibo sensitivity should have permitted the detection of the other tentatively reported H I clouds, none were reconfirmed, showing once again that intergalactic H I clouds without optical counterparts are very rare beasts indeed.

Lee (Arizona), Salzer (Wesleyan), Impey (Arizona), Thuan (Virginia), and Gronwall (Johns Hopkins) made 21-cm observations of a complete sample of 109 low luminosity ($M_B > -18.0$), nearby ($cz < 11{,}000$ km/s), Hα-selected star-forming galaxies from the KISS catalog. The detection rate was 89%. The sample includes true dwarf galaxies, as well as larger, heavily-extincted, edge-on spiral galaxies. This is reflected in the broad distribution of H I line widths. The range of H I gas richness for the sample is the same as in previous H I surveys of late-type galaxies. Their galaxies are shown to have a wide range of dark-to-visible mass fractions. The median H I gas depletion time-scale for this sample increases from 5 to 13 Gyr when a metallicity-dependent SFR is used to calculate time-scales instead of a solar-metallicity SFR. One interpretation of these statistics is that these galaxies will not deplete their gas supplies for another Hubble time if they continue to form stars at their current rate. These results also lift the requirement that these galaxies have star formation histories dominated by short bursts of activity, and show that a more nearly continuous mode of star formation is possible. By computing an H I mass function for this sample, it is shown that the low luminosity star-forming galaxies in KISS contain 10-15% of the overall H I in the Universe.

Terzian (Cornell), Lewis (NAIC), and Arecibo REU summer students Chomiuk (Wesleyan), Morris (Chicago), and Moser (Illinois) observed recombination lines from interstellar clouds at C- and S-band. One nebula, S88, coincides with a compact red object, is associated with a thermal radio source, and is embedded in a complex molecular cloud. Several molecular species have been detected from its vicinity. The ionized plasma of the nebula undergoes recombinations that at high quantum levels result in line emission at radio frequencies. The team measured the H125α (3.4 GHz) and H109α (5.0 GHz) lines from this nebula. In the same program, recombination lines were detected from six planetary nebulae. The sensitivity offered following recent adjustment of the telescope primary surface promises fruitful observations to come.

Stanimirovic (NAIC), Chomiuk (Wesleyan), Bhat (NAIC), Lorimer (Jodrell Bank), Salter (NAIC) and Urosevic (Belgrade) observed the supernova remnant (SNR) G42.8+0.6. This seems to be a typical, faint, shell-type SNR, but has two unusual neutron stars projected just outside it. One is the soft-gamma repeater SGR 1900+14, a magnetar with 5.16-s pulses in the X-ray. The other, J1907+0918, is a young pulsar discovered at Arecibo while searching for radio pulses from SGR 1900+14. It is possible that the SNR marks the birth-place of either, or both, of these neutron stars. Sadly, distances to all three are rather uncertain. The team are looking for connections between the objects. Several approaches to constraining the distances of PSR J1907+0918 and the SNR are being attempted, including deriving their rotation measures (RMs), and searching for HI absorption by clouds situated in front of the SNR.

Neufeld (Johns Hopkins), Kaufman (San Jose State), Goldsmith (Cornell), Hollenbach (NASA Ames), and Plume (U. Calgary) have combined the first detection of water vapor in a diffuse cloud with extensive Arecibo OH observations along the same line of sight. These observations are particularly valuable because the absorption lines of both molecular species appear optically thin in the 6 km/s feature towards the bright H II Region. Although the region of massive star formation is estimated to be at 6.5 kpc, the diffuse cloud is likely relatively close to us. The particular importance of observing these two species together is that they provide a test of laboratory measurements of a key chemical reaction in dense interstellar clouds. This is the dissociative recombination of the molecular ion H_3O^+, which has channels resulting in OH + H_2, H_2O + H, and finally atomic oxygen with hydrogen in a combination of atomic and molecular forms. The branching ratio of this reaction plays a critical role in determining the abundance of H_2O (which can be a major cloud coolant), and of OH, which is thought to lead to O_2 via neutral-neutral reaction with O. Previous SWAS observations have indicated low H_2O abundances. However, suppressing this channel did not seem viable given the measured abundances of other species, including OH and O_2. The Arecibo results argue against the very low branching ratio for H_2O formation, but the variations suggest that there may be a contribution in one or both of these clouds from a warm gas component having temperature >400 K, which allows an enhanced rate of neutral-neutral reactions.

Baan (Westerbork), Hofner, and Araya (U. Puerto Rico) conducted a C-band survey of extragalactic formaldehyde (H_2CO). They observed the H_2CO (1_{10}-1_{11}) transition (4829.67 MHz) toward 63 extragalactic objects. The sample comprises earlier detected sources, ultra-luminous FIR galaxies known to have OH megamasers, and nearby FIR galaxies. Also observed simultaneously was the H110α recombination line (4874.16 MHz) towards a sub-sample of 54 sources. The observations have resulted in a total of ten sure or tentative detections. These comprise four H_2CO absorbers, five H_2CO emitters, and one H110α emitter. The detections include H_2CO from Arp 220 and IRAS 15070+0727 and the first detection of H110α from the giant HII region NGC 604 in the galaxy M33.

Watson (U. Wisconsin), Araya (U. Puerto Rico), Sewilo, Churchwell (U. Wisconsin), Hofner (U. Puerto Rico), and Kurtz (UNAM, Mexico) carried out the second Arecibo Survey of H110α and H_2CO 6-cm lines toward regions of massive star formation in the inner Galaxy. The project's main objective was to resolve the distance ambiguity of massive star forming regions located in the galactic longitude range of the SIRTF/GLIMPSE survey visible from Arecibo. The kinematic method to determine distance is based on the axially symmetric velocity field of the galactic plane. The inversion of such a velocity field, for a given LSR radial velocity, gives a unique solution for the galactocentric distance, but the LSR distance has two solutions. This is commonly referred to as the ''distance ambiguity problem.'' Araya *et al.* had previously observed the recombination line H110α and the H_2CO 4829-MHz transition to resolve the distance ambiguity. The same technique has been used in this project for a sample of 54 ultra-compact HII regions. The distance ambiguity was resolved for 44 of the 54 sources.

Kalenskii, Slysh (ASC, Russia), Goldsmith (Cornell), and Johansson (Onsala, Sweden) observed the famous molecular cloud TMC-1 at C-band and X-band. They detected the already known H_2CO, HC_5N, and HC_7N lines. However, in more sensitive observations at selected frequencies they detected lines of C_2S, C_3S, C_4H, HC_3N, $HCC^{13}CN$, HC_5N, HC_7N, and HC_9N, about half of which were detected for the first time. Their results demonstrate that low frequency observations can be useful for the study of cold molecular clouds. Most of the new lines were detected at X-band; therefore molecular observations around 10 GHz seem more promising than those at lower frequencies.

Troland (U. Kentucky) and Crutcher (U. Illinois) continued a long-term project to observe the Zeeman effect in dark-cloud cores. The observations have involved sensitive measurements of Stokes parameter I and V line profiles in the quasi-thermal 1665- and 1667-MHz OH lines. These lines have high Zeeman sensitivity and probe n(H2) $\sim 10^4$ cm^{-3}. They aim to test the current ''standard model'' of low-mass star formation, in which self-gravitating magnetically supported molecular clumps undergo core collapse when ambipolar diffusion reduces magnetic support in central regions. No other known technique (including the Zeeman effect in other molecular species) offers this level of sensitivity to magnetic fields in molecular cores. The first results from this survey included a detection of the OH Zeeman effect toward the Taurus dark cloud core L1544, with $B_{los} = +11 \pm 2$ μG. This field strength implies a magnetic field too weak to support the cloud against gravity. Evidence has been presented by others suggesting that L1544 has infall motions and may be collapsing. By the end of this project, the team will have sensitive observations of magnetic field strengths toward several dozen dark cloud cores. These data will enable a statistically meaningful study of the mean value of mass-to-flux ratios in cores and answer the question of whether magnetic fields control the process of star formation.

Darling (Carnegie) undertook long-term monitoring of four OH megamasers (OHMs) as well as a program to characterize short-term variability of two OHMs with strong emission lines (the time-scales sampled ranging from 1 day to about 1 month). Long-term monitoring is designed to measure or constrain accelerations in OH lines due to orbital motions in gas. As is seen in nearby OHMs, the masing gas often appears in the form of a torus suggesting a large concentration of mass, and accelerations in lines combined with some information about the geometry of the masing gas can indicate a geometrical distance, as it has in the water-maser galaxy NGC 4258. Short-term monitoring constrains the size scales of variable and quiescent masing regions and provides strong constraints on maser models and the physical setting for OHMs.

Lane (NRL) and Heiles (Berkeley) attempted to measure the magnetic field in the $z=0.0912$ HI damped Ly-α absorption system towards the quasar B0738+313 via Zeeman splitting. This system is one of the strongest known redshifted 21-cm absorbers visible from Arecibo, making it an ideal candidate for this experiment. Preliminary results indicate that the upper limit on the strength of the line-of-sight magnetic field is $B_{||}=2\pm2.25\ \mu$G. This is consistent with measurements made in H I clouds in our Galaxy. As Zeeman splitting is not sensitive to magnetic fields oriented perpendicular to the line of sight, no conclusions can be drawn about the total magnetic field in this system.

Jeyakumar (U. Koeln, Germany), Saikia (NCRA, India), Salter, Ghosh (NAIC), and Stutzki (U. Koeln, Germany) searched for H I absorption and OH emission or absorption against a sample of 16 compact steep spectrum (CSS) and other radio sources. They found a complex, multi-component H I absorption system towards 3C258. The CSS radio galaxy 3C258 lies at a redshift of 0.165, and has two radio lobes separated by only 380 pc. Compared to other known CSS H I-absorption spectra, 3C258 contains probably the most complex absorption system, with the fitted components having about an order of magnitude narrower velocity widths than most features in the other CSS sources. Although detailed modeling of the H I gas seen in absorption in this galaxy will require VLBI imaging of the line and continuum emission, it is difficult to imagine that a single rotating disk/torus would produce such a complex absorption system. It may be that jet-ISM interactions play the dominant role in shaping the structural properties of the object.

Giovanelli, Spekkens, Springob, Masters, Catinella, and Haynes (Cornell) began a spectral line mapping program designed to detect H I clouds down to a mass limit of $10^{6.5}$ $M_\odot$ in the very local universe. While the main objective of this program is to probe the faint end of the H I mass function, it will also allow a comparison of the quality of baselines derived from drift-scan and on-the-fly mapping, a question with significant ramifications for future ALFA extragalactic H I survey strategies. Cold dark matter numerical simulations predict the existence of large numbers of low-mass halos, well in excess of the faint tail of the galaxy luminosity function. This prediction has prompted the reevaluation of the idea that some relatively compact, high velocity H I clouds may be the ‘‘missing’’ population of low-mass halos in the Local Group. Large blind H I surveys disagree by an order of magnitude in the estimate of the space density of objects with masses of $M_{HI}\sim10^7$ $M_\odot$. The current survey aims at resolving this discrepancy.

Gardner (U. Pitt.), Catinella, Haynes, Giovanelli (Cornell), and Connolly (U. Pitt.) observed the H I emission from a sample of galaxies with $0.04<z<0.09$ to explore the cross calibration of the H I, long-slit Hα and SDSS linewidth relations. Line widths have now been extracted and a comparison is being made of the linewidths measured by different tracers or techniques and with the results of simulations of the instrumental limitations. The cross calibration of the optical and radio Tully-Fisher relations is underway.

Robishaw, Simon, and Blitz (Berkeley) continued their Arecibo investigation of an apparently interacting system that consists of a high-velocity cloud (HVC) and a Local Group dwarf galaxy. The HVC was discovered during their survey of Local Group dwarfs observable with Arecibo. Due to the faint H I tails that they saw extending away from the main body of the HVC, and the proximity of the HVC to the Local Group dwarf spheroidal galaxy LGS 3, they proposed that the two objects were interacting tidally. Already unique because of this possible interaction (implying a distance of $\sim$700 kpc to the HVC), the HVC was rendered even more intriguing by the finding that it contains a smooth velocity field indicative of rotation. With the high-sensitivity, high-resolution combined map, they will test the tidal interaction hypothesis by comparing it with theoretical models. This, they hope, will elucidate the history of the system and provide further constraints on the structure of the HVC.

Pisano (ATNF), Garland, Williams (U. Hawaii), Guzman (U. Florida), and Castander (IEEC-Barcelona) began a study of the HI content and kinematics of nearby Luminous Compact Blue Galaxies (LCBGs) as part of a larger multiwavelength campaign to better understand their more distant analogs. LCBGs at intermediate redshifts are blue, vigorously star-forming, high surface brightness galaxies which undergo dramatic evolution. They are not necessarily related to the more commonly known Blue Compact Dwarfs. At $z\sim1$, LCBGs have a total star formation rate equal to that of grand design spirals, but their number density is decreased by an order of magnitude by $z\sim0$. It is not known what drives their rapid evolution, nor what is their final state. To date, the team has obtained H I spectra for 14 nearby LCBGs selected from the Sloan Sky Survey. Based on a preliminary analysis of these galaxies and others observed with the GBT, nearby LCBGs are H I-rich, with masses ranging from 5×10^8 to $9\times10^9 M_\odot$, and have large dynamical masses ranging from 5×10^9 to $2\times10^{11} M_\odot$. Using IRAS fluxes to determine star formation rates, they find that their sample has gas depletion timescales ranging from 5×10^8 to 10^{10} yr. These properties imply that while LCBGs are a diverse collection of galaxies, they tend to be high mass objects which have the potential for future bursts of star formation.

Levy and Rose (U. No. Carolina) made H I observations of the Pegasus I cluster for the purpose of identifying the cluster mechanism responsible for the rapid evolution of the star formation in such clusters. The Pegasus cluster represents a unique environment, of particular interest because it has a richness similar to the Virgo cluster, while at the same time a virtually undetectable level of X-ray emission and very low velocity dispersion. The low velocity dispersion, coupled with the lack of a dense hot ICM, indicates that ram pressure stripping should not play a significant role in this environment. Nevertheless, important environmental effects are taking place in the cluster, as a number of early-type galaxies exhibit evidence for recent, centrally concentrated, star formation. Thus Pegasus I provides an unusual situation in which to isolate the effects of tidal perturbation on the evolution of its galaxies, unless tidal stripping is more effective in low velocity dispersion environments than previously considered. The main goal of the new observations is to clarify the conflicting claims regarding whether there is H I depletion in spirals in the Pegasus cluster. Resolving this issue is fundamental to determining whether ram pressure stripping is effective in a wider variety of cluster environments than previously thought. With the above goal in mind, they have acquired new 21-cm observations of 48 spiral galaxies in the Pegasus I cluster. With their new H I observations, in conjunction with better blue magnitudes than were available for previous studies, they conclude that there is no sign of overall H I deficiency for spirals in the Pegasus I cluster.

Cabanela and Roscioli (Haverford) made H I observations to acquire a large enough sample of ''blue edge'' galaxies in the Pisces-Perseus supercluster (PPS) region to map out their distribution relative to the large-scale structure of the PPS. The scientific goal is to obtain a better understanding of the environments that host Low Surface Brightness (LSB) galaxies, of which the ''blue edge'' galaxies (named for their location in a POSS I color-magnitude diagram) are a subclass. From 150 targets, they have detected 86 of their ''blue edge'' galaxies in H I, meaning that they now have identified over 100 likely LSBs in the field of a single supercluster. It is clear from the new results that the LSBs trace out the same large scale structures as the ''normal'' high surface brightness galaxies. They are now working on a more quantitative analysis of the z distribution of these LSB candidates within the field, and also combining their new LSB catalog with the extensive H I observations of Giovanelli *et al.* of ''normal'' galaxies in the PPS field to allow a clearer determination of the trends of surface brightness and H I content versus environmental density than has been previously possible.

Lovell (Agnes Scott), Howell (NAIC), Schloerb (FCRAO), Lewis, and Hine (NAIC) observed OH in 6 comets: C/1999 S4 LINEAR, C/1999 T1 McNaught-Hartley, C/2001 A2-B LINEAR, 153P/Ikeya-Zhang (2002 C1), C/2000 WM1 LINEAR, and C/2002 F1 Utsunomiya. The 18-cm OH lines are a valuable diagnostic of conditions in comet comae. The brightness of the OH lines is related to the total OH production in the coma, and the line shape contains information on the gas outflow velocity. Spectra were obtained at 1612, 1665, and 1667 MHz with a spectral resolution of 68.6 m/s. The observed spectra show very interesting line shapes which provide valuable constraints on Λ-doublet inversion models. Monte Carlo models were run for both day- and night-side emission over a range of OH parent velocities and quenching radii using 2 different models for the inversion. For each date, the best-fit model to the data was used to estimate the OH production rate. When maps were made, they were consistent with small quenching radii for these low-production rate (10^{28}–10^{29} mol/s) comets. While the best fit for 153P/Ikeya-Zhang is consistent with a quenching radius of 50,000 km, all other maps yield quenching radii $<$10,000 km.

6.2 Pulsar Radio Astronomy

Camilo, Gotthelf, Halpern, Mirabal (Columbia), Lorimer (Jodrell Bank), Bhat (NAIC), Wang, and Lu (U. Mass.) used Arecibo to discover pulsations from PSR J1930+1852, a young, energetic pulsar at the center of SNR G54.1+0.3 with a period of 136 ms. The morphological and spectral properties of SNR G54.1+0.3 revealed by Chandra X-ray Observatory left no room for doubt as to the presence of a central pulsar. However, it is vital to measure its period (which Chandra could not do) and period derivative, and thereby determine its characteristic age and spin-down luminosity. The team has derived a characteristic age of 2900 yr (estimating an actual age for the pulsar and SNR in the range 1500–6000 yr), spin-down luminosity of 1.2×10^{37} erg/s and surface magnetic dipole field strength of 1.2×10^{13} Gauss. This places PSR J1930+1852 in the group of ten pulsars with the highest known values of spin-down luminosity and lowest apparent ages. The discovery of the young pulsar powering G54.1+0.3 will enable a better understanding of SNR energetics.

Lorimer, McLaughlin (Jodrell Bank), Xilouris (UVA), Backer (Berkeley), Cordes (Cornell), Fruchter (STScI), Arzoumanian (Goddard), and Lommen (Amsterdam) continued processing drift-scan data taken with the 430-MHz Carriage House towards the end of the Arecibo upgrade. So far, 850 deg^2 of sky have been successfully processed and 33 pulsars detected, ten of which are new. Highlights of the new discoveries include a 5.79-ms pulsar at high Galactic latitude and a 55.7-ms pulsar in the Galactic anticenter. The latter is a solitary object with an estimated spin-down age of 2 Myr and a magnetic field of only 2×10^{11} G. If this is confirmed by further observations, it places this pulsar in a fairly unique position in the P-$\dot{P}$ diagram.

Bogdanov (Penn St.), Soltysinski (Szczecin U., Poland), and Wolszczan (Penn St.) completed the initial study of PSR J1752+23, a pulsar discovered in the Penn State/Arecibo surveys and characterized by unusually long nulling periods. PSR J1752+23 spends 70–80% of its time in a ''quasi-null'' state, with ''bursts'' occurring once every 400–600 periods and typically lasting about 100 periods. With its $P=0.409$ s and $\dot{P}=0.6\times10^{-15}$ s/s, PSR J1752+23 is a fairly typical member of the slow pulsar population. However, it does not follow the standard assumption that nulling pulsars are mostly found close to the hypothetical ''death line'' in the P-$\dot{P}$ diagram. Similarly, it does not conform to the common description of nulling, because it switches off gradually, rather than suddenly. Another difference in PSR J1752+23 is that a very low-level pulsed emission is continuously present during the null state. Finally, the astonishing morphological similarity of the on-states and their very similar timescales and repetition rates are unique among nulling pulsars. These emission characteristics of PSR J1752+23 make it exceptional among the pulsar population. It appears most natural to assume that its unusual properties are related to the pulse emission mechanism.

Ransom (McGill), Stairs (NRAO), Hessels, Kaspi (McGill), and Lorimer (Jodrell Bank) found a new binary millisecond pulsar (MSP) in M71. This is the first pulsar discovered in this cluster. This brings the total of new MSPs discovered by this team to four (which also includes two new pulsars in M13 and one in M5). M71A is an eclipsing 4.8-ms system in a 4.2-hr orbit around a very low-mass companion ($\gtrsim 0.03$ $M_\odot$), which is typical of the burgeoning class of eclipsing binary MSPs. Recent Arecibo observations also showed that the new MSP discovered in M5 (M5C) undergoes eclipses, with an orbital period of 2.1 hr, and has a companion with a mass $\gtrsim 0.04$ $M_\odot$. Additionally, an orbital solution was found for the new MSP, M13D, giving an orbital period of 14 hr, and a more massive companion ($\gtrsim 0.17$ $M_{\odot}$).

Roberts (McGill/MIT), Hessels (McGill), Ransom, Kaspi (McGill/MIT), Freire (NAIC), Crawford (Haverford), and Lorimer (Jodrell Bank) discovered a young pulsar in the error box of a high energy γ-ray source known since the days of the *COS B* satellite. This young (characteristic age 17 kyr), energetic (spin-down luminosity 3.4×10^{36} ergs/s), 104-ms pulsar was found in the direction of X-ray source AX J2021.1+3651. PSR J2021+3651 lies in the error box of the hard-spectrum, low-variability γ-ray source 3EG J2021+3716. This association, along with the high inferred spin-down luminosity of the pulsar, strongly suggests that J2021+3651 emits pulsed γ-rays, a very exciting prospect as there are currently only a handful of confirmed γ-ray pulsars.

Freire (NAIC), Anderson (Caltech), Navarro (Schlumberger), and Jenet (Caltech) began a timing project aimed at confirming the eccentricity and characteristic age of binary pulsar PSR J2016+1947. The PSR J2016+1947 system promises to excel as a tool to test the Strong Equivalence Principle (SEP), the basic foundation of General Relativity. This principle requires the universality of free fall, even for objects that have very significant gravitational self-energies. Thus, both PSR J2016+1947, with its very large (negative) self-gravitation energy, and the white dwarf companion, with its negligible self-gravitational energy, should fall in the Galactic gravitational field with the same acceleration. However, if the assumption of SEP is wrong, as postulated in many alternative gravitational theories, the accelerations for the pulsar and the white dwarf will be different. This produces an increase in the eccentricity of the system, which becomes more pronounced for wider orbits.

Stinebring (Oberlin) and collaborators continued their observations of ''scintillation arcs'' in pulsar dynamic spectra. These arcs arise from interference between various parts of the spatially coherent pulsar image. The dynamic spectra are remarkably rich in features when explored with Arecibo's sensitivity. Stinebring analyzes a dynamic spectrum by taking its two-dimensional power spectrum, forming what is known as a ''secondary spectrum,'' in which the scintillation arcs appear as sharply delineated parabolic arcs. It appears that the essential ingredient needed to produce the arcs is interference between a bright central core of the image and a more extended halo.

Gupta (NAIC/NCRA, India), Bhat (NAIC), and Gangadhara (IIA, India) made single-pulse observations of a sample of bright, well-known pulsars to carry out a detailed study of radio-pulsar emission geometry. This was motivated by the work of Gupta and Gangadhara, who showed that the emission regions for some pulsars contain multiple hollow emission cones surrounding a central core beam, with the conal beams showing systematic retardation and aberration effects. Observations of most bright, Arecibo-visible pulsars with multi component profiles were made, largely at 432 and 1175 MHz, with a few also being observed at 2250 and 5000 MHz. Basic data reduction has been largely completed, and detailed analysis for modeling the emission geometry is underway.

Stairs (NRAO), Thorsett (UCSC), Taylor (Princeton), and Wolszczan (Penn St.) submitted a paper describing long-term timing of the relativistic double-neutron-star binary pulsar B1534+12. The observations span 4 yr pre-upgrade, and 4.5 yr post-upgrade. Like PSR B1913+16, B1534+12 provides stringent tests of the predictions of general relativity. For B1534+12, the measured values of the advance of periastron, the time dilation parameter and the shape of the Shapiro delay agree with the predictions of general relativity to within 0.05%. The observed orbital period derivative, affected by the relative acceleration of the pulsar system and the Solar System Barycenter, provides a greatly refined measurement of the distance to the pulsar: 1.02 ± 0.05 kpc. The masses of the two neutron stars can also be derived from the timing solution. It is now clear that the observed recycled pulsar is significantly less massive than its younger companion, contrary to initial expectations from most binary evolution theories in which mass is transferred from the companion to the older neutron star.

Cordes (Cornell), Bhat (MIT), Hankins (New Mexico Tech), McLaughlin (Jodrell Bank), and Kern (New Mexico Tech) conducted an extensive multi frequency campaign observing Crab Pulsar giant pulses using all available Gregorian-dome receivers, as well as the Observatory's fast-dump, real-time correlator system, the Wide-band Arecibo Pulsar Processor (WAPP). Data were taken over a frequency range from 0.43 to 8.8 GHz at time resolutions of 10–100 μs. This has led to several interesting results pertaining to the nature of the giant pulses and their frequency dependence, and valuable insights into the influence of the Crab Nebula on the pulsar's radio emission. The observations show that giant pulses occur only in the main pulse and interpulse components, and that giant pulses follow the interpulse in pulse phase as it shifts to earlier phases above 4 GHz. This may suggest that the same physical region is responsible for both the low-frequency and the shifted high-frequency interpulse. The high time and frequency resolutions inherent in the data enabled these observers to identify and quantify frequency structure in individual giant pulses, using a scintillating, amplitude-modulated, polarized shot-noise model. The most plausible interpretation is that the multipath propagation is strongly influenced by the Nebula filaments, thus providing useful constraints on filament motions.

Hankins, Kern, Eilek, and Weatherall (New Mexico Tech) observed Crab giant pulses at ultra-high time resolution. They discovered isolated, highly polarized, two-nanosecond subpulses within the Crab pulsar's giant pulses. The source region for such nanopulses must be less than a meter in size. This would make the Crab nanopulses the smallest structures resolved outside the solar system and the brightest transient radio sources in the sky. The current preferred mechanism for generating the nanopulses is wave packets of strong plasma turbulence in the pulsar magnetosphere.

Lorimer (Jodrell Bank), Xilouris (U. Virginia), Fruchter (STScI), Stairs (U. Br. Columbia), Camilo (Columbia), Vazquez, and Eder (NAIC) carried out regular timing observations of the binary millisecond pulsar J0407+1607. This pulsar, discovered in a drift-scan survey by Fruchter in 1994, is a 25.7-ms pulsar in a 669-day orbit about a low-mass (0.2

$M_\odot$) companion. Using the new timing solution, the orbital eccentricity of this system is now known to reasonable precision (0.00097±0.00002) and is in line with theoretical predictions for long-period binary pulsars. Further, like the 635-day binary pulsar J2016+1947, J0407+1607 will provide an excellent test of general relativity and, in particular, the strong equivalence principle.

Lorimer, McLaughlin (Jodrell Bank), Arzoumanian (GSFC), Xilouris (U. Virginia), Cordes (Cornell), Backer (Berkeley), Lommen (Franklin & Marshall), and Fruchter (STScI) began timing observations for the new pulsars discovered by the Arecibo PSPM drift-scan surveys. So far, 11 new pulsars have been confirmed in the survey of over 1000 deg^2. Highlights include a 55.7-ms pulsar, J0609+2130, for which an ephemeris has now been obtained, two msec pulsars (still under investigation) and several bright long-period pulsars. Its timing solution, now spanning almost a year, show it to be old (characteristic age ~2 Gyr) with a relatively weak magnetic field (5×10^9 G). J0609+2130 is similar in many respects to J2235+1506, discovered in a pre-upgrade drift-scan survey and thought to be a relic of a disrupted double neutron-star binary system (i.e., a ''failed'' Hulse-Taylor binary pulsar). Of the long-period pulsars found so far, the most interesting is J0815+09, it having a most unusual pulse profile which defies standard classification schemes. Single-pulse PSPM data show an extremely ordered pattern in the individual pulses. The unusual profile morphology and the drifting subpulse behavior are under further study as the timing observations continue.

Nowakowski, Sotero (U. Puerto Rico), Bhat (NAIC), and Lorimer (Jodrell Bank) undertook a study of several bright pulsars in the Arecibo sky for details related to the mode-switching, nulling and drifting phenomena. Analysis also aims at the integrated profiles and their relationship to locations of emission regions in the magnetospheres of pulsars. In the first phase of the project, 1175-MHz observations have been made of five pulsars. Several new results have emerged from studies of intensity dependence of the pulse structure and stability for PSR B0950+08. This pulsar shows both a main pulse and interpulse. It remains a puzzle whether the main pulse and interpulse are emitted from two opposite magnetic poles (nearly orthogonal rotator) or from one pole (nearly aligned rotator), where the geometry of the emission region is such that there are two maxima per period. Adopting the more commonly favored model of an orthogonal rotator, the new results suggest that the weaker pulses are emitted from higher altitudes in the magnetosphere.

Freire (NAIC), Lorimer, McLaughlin (Jodrell Bank), Cordes (Cornell), Bhat (MIT), Kramer, and Lyne (Jodrell Bank) began a new pulsar pilot survey at 327 MHz. Pulsars are steep spectrum sources; generally, their flux densities at 327 MHz are about a factor of two larger than at 430 MHz. Hence, the 327-MHz receiver increases the distance to which a given pulsar is detectable by a factor of $\sqrt{2}$ compared to the 430-CH system. The volume being covered by a 327-MHz survey is thus $2^{3/2}$ times that of a 430-CH survey. As the HPBW is larger at 327 MHz (15′) than with 430-CH (9′), a 327-MHz drift-scan survey should detect up to three times more pulsars per unit time as the prolific Arecibo 430-CH drift-scan surveys, while needing only 0.6 times as many beams to cover the Arecibo sky. If the results of this pilot survey confirm the predictions, then a 327-MHz all-sky survey, complementary to the ALFA pulsar surveys of the Galactic plane, could be considered, possibly carried out using the resources of the ALFA pulsar consortium. Such a survey could potentially find hundreds of new pulsars and many dozens of recycled objects.

Freire (NAIC) began timing observations of PSR J1738+0333, a 5.85-ms pulsar discovered at Parkes by Jacoby and Bailes. This pulsar is a member of a binary system with a 0.1 $M_\odot$ white dwarf companion. Of all the pulsar-white dwarf binaries in the Galactic disk, this has the second shortest orbital period, only 8.5 hr. Parkes measurements indicate that its eccentricity is $<10^{-5}$. Such circularity, if very well determined for a set of tight binary pulsars, is interesting for several reasons. It allows measurements of the most fundamental properties of spacetime, like the Lorenz invariance, which is really a statement that empty spacetime is isotropic and has no preferred reference frames. If it is not, then either the motion of the binary relative to the preferred frame, or the anisotropy of space itself, should induce an eccentricity along the direction of motion and/or along the direction of the spacetime anisotropy. With time, this system might also be useful for putting upper limits on the variation of the gravitational constant with time, which is still a topic of debate in cosmology.

6.3 Radar Astronomy

Campbell (Cornell), Margot (Caltech), Nolan (NAIC), Ostro, and Benner (JPL) made S-band radar observations of near-Earth asteroid 2002 NY40 when it passed within 0.0035 AU. Because of the short light travel time for this object, it was necessary to receive the Arecibo radar transmissions with the Green Bank Telescope. The delay-Doppler images show this object to be in the shape of a contact binary measuring 600 m in size along the long axis.

Nolan, Howell (NAIC), Benner, Ostro, Giorgini (JPL), and Margot (Caltech) made S-band radar observations of near-Earth asteroid 5381 Sekhmet. The radar image revealed this to be a binary system, making this the seventh binary NEA to be discovered with the Arecibo and/or Goldstone radars. Sekhmet was found to be smaller (< 1 km) than predicted, with a high radar albedo and rapid (2.5 hr) rotation rate.

Ostro, Chesley, Giorgini, Benner (JPL), and Margot (Caltech) made S-band radar observations of the near-Earth asteroid 6489 Golevka. The main purpose of these observations was to test the Yarkovsky Effect, a subtle nongravitational phenomenon involving accelerations of an object due to anisotropic thermal emission of absorbed sunlight. Although this effect has been theorized to play an important role in the long-term evolution of asteroid orbits and spin, it had never been confirmed observationally. It has been argued that precise asteroid orbit determination from radar can be used to detect the effect. Preliminary results from these new observations are, in fact, consistent with the Yarkovsky predictions.

Nolan (NAIC), Magri (U. Maine) and collaborators made S-band radar observations of Vesta when this large mainbelt asteroid offered its best observing opportunity for the next century. Delay-Doppler images were obtained which will be used to improve the shape model and to look for features related to the presence of a putative large crater. Such a large crater would be consistent with HST images and could be the source of the Vesta family of meteorites and small asteroids.

Campbell (Cornell), Black (NRAO), Carter (Cornell), and Ostro (JPL) continued their program of S-band radar observations of Titan. Some of these observations were made using the Green Bank Telescope as a receiving station. Most of the echo power has been found to be contained in a broad diffuse component. However many of the spectra show a weak specular echo corresponding to reflections from a very smooth low dielectric constant surface at the sub-earth location. The normalized radar backscatter cross section as a function of sub-earth longitude correlates very strongly with the 2 μm albedoes, including the large near-IR feature centered near 90 deg longitude. These cross sections and the circular polarization ratios are very different from those of the icy Galilean satellites but similar to those for the trailing hemisphere of Iapetus. The echo power and Doppler widths of the specular components are consistent with reflections from bodies of liquid hydrocarbons and provide the best evidence to date for their presence on Titan.

Black (NRAO), Campbell, Carter (Cornell), and Ostro (JPL) made S-band radar observations of another Saturnian satellite, Iapetus. A detection was made of the satellite's dark leading hemisphere. The radar reflectivity was found to be similar to that of Iapetus' bright trailing hemisphere, which had been detected in earlier Arecibo radar observations. Apparently, whatever is responsible for the strong optical albedo contrast between leading and trailing faces has little or no effect on the radio dielectric properties. Another interesting finding is that Iapetus' radar scattering properties are fundamentally different from those of the three icy Galilean satellites.

B. Campbell (Smithsonian) and D. Campbell (Cornell) made 70-cm radar observations of the Moon to search for evidence of ice at the lunar south pole. Arecibo S-band radar imaging of the south pole from a decade earlier had shown no evidence for the sort of icy backscatter features seen from shaded craters at the poles of Mercury. It was thought possible that probing deeper with a longer wavelength might get down to buried ice inaccessible to S-band. The new 430-MHz observations have yielded excellent delay-Doppler images of the lunar south pole. These bear a very strong resemblance to the earlier S-band images and show no obvious ice-like echoes.

Nolan and Harmon (NAIC) made S-band radar observations of Comet C/2002 O6 (SWAN) when it approached to within 0.26 AU of the Earth. The observations yielded a weak broadband echo from large coma grains, but no nucleus detection. This was only the ninth comet to be detected by radar and the fifth comet to show an echo from large grains. The 1.1 km^2 cross section measured for this comet was similar to that seen in the grain-coma echoes from other comets. The Arecibo detections of this comet and C/2001 A2 (LINEAR) a year earlier have provided additional support for the importance and prevalence of large-grain emission by comets.

6.4 VLBI

Lazio (NRL), Goss, Brogan (NRAO), Faison (Northwestern), Zauderer, and DePree (Agnes Scott) observed 3C 138 in an H I-absorption VLBI experiment involving Arecibo. The objective of the experiment was to image the H I absorption toward 3C 138, this time with sufficient sensitivity to confirm or refute the tentative detection of Zeeman splitting in their earlier observations.

Lonsdale (IPAC), Smith (UCSD), and Diamond (Jodrell Bank) made VLBI observations of the merging galaxy Arp 220 using several large European dishes, the VLBA, the phased-VLA, the GBT, and Arecibo. When combined with almost continuous recording at a rate of 256 Mbit/sec, this experiment is probably the most sensitive VLBI observation to date. The more than 3-fold improvement in SNR afforded by Arecibo, the GBT, and a wider recording bandwidth has resulted in the detection of roughly 30 radio supernova candidates in Arp 220, about ten of which are found in the eastern nucleus. The preliminary image constitutes dramatic evidence that intense star formation is occurring in both nuclei, and not just the western one.

7. OBSERVING PROGRAMS

The following list gives the numbers, titles, and coauthors of all observing proposals scheduled on the Arecibo telescope during the period from July, 2002 through June, 2003.

7.1 Spectral Line Radio Astronomy

A1312 - *Light Travel Time Dimensions for* $|b|>10°$ *OH/IR Stars* - Lewis, B. (NAIC).

A1328 - *On Connections between AGB Stars and Planetary Nebulae* - Tat, H. (Cornell), Lewis, B. (NAIC), Terzian, Y. (Cornell).

A1444 - *V1511 Cyg: The Prototype for Newly Born OH/IR Stars* - Lewis, B. (NAIC).

A1452 - *HI Observations of Low Redshift Galaxies That Hosted a Supernova* - Lewis, B. (NAIC), Terzian, Y. (Cornell).

A1457 - *A Crucial Test of the Role of Magnetic Fields in Star Formation* - Troland, T. (U. Kentucky), Crutcher, R. (U. Illinois).

A1459 - *2MASS Galaxies in the Zone of Avoidance* - Schneider, S. (U. Mass.), Huchra, J. (Harvard), Pantoja, C. (U. Puerto Rico).

A1474 - *Regular Monitoring of Calibration Parameters for the AO Receivers* - Heiles, C. (Berkeley), Salter, C., Perillat, P. (NAIC).

A1475 - *KISS Dwarfs: The HI Properties of a Complete Sample of Active Star-forming Dwarf Galaxies* - Lee, J. (U. Arizona), Salzer, J. (Wesleyan), Impey, C. (U. Arizona).

A1518 - *OH Masers for VLBI* - Slysh, V. (Astro. Space).

A1524 - *Follow-up on the Arecibo Set of OH/IR Stars* - Lewis, B. (NAIC).

A1542 - *Follow-up on Birth and Death among Arecibo OH/IR Stars* - Lewis, B. (NAIC).

A1543 - *HI Narrow Line Absorption: A New Tracer for Measuring Magnetic Fields in Dense Molecular Clouds* - Li, D. (Cornell), Heiles, C. (Berkeley), Goldsmith, P. (NAIC), Troland, T. (U. Kentucky), Turner, B. (NRAO).

A1575 - *Kinematic Distances to Massive Star Formation Regions in the Inner Galaxy* - Churchwell, E., Sawilo, M. (U. Wisconsin), Araya, E., Hofner, P. (U. Puerto Rico).

A1579 - *Spectral Scan of Galactic Star Forming Regions TMC-1 and W51 at Low Frequency* - Kalenskii, S., Slysh, S. (Astro Space), Goldsmith, P. (NAIC), Johansson, L. (Onsala).

A1581 - *Extended Atomic Hydrogen in the Leo Triplet* - Bolatto, A. (Berkeley), Walter, F. (Caltech), Simon, J. (Berkeley), Dahlem, M. (ESO), Robishaw, T. (Berkeley).

A1583 - *Statistically Sampling HI and OH Zeeman Splitting with Absorption Lines* - Troland, T. (U. Kentucky), Heiles, C. (Berkeley).

A1584 - *HI Properties of a Large, Complete Sample of Optically Selected Galaxies in Nearby Voids* - Grogin, N. (STScI), Lee, J. (U. Arizona), Dell'Antonio, I. (Brown).

A1587 - *The OH Light Curve of IRAS 22402+1045* - Lewis, B. (NAIC).

A1589 - *On the Imminent ''Death'' of the OH/IR Star 15060+0947* - Lewis, B. (NAIC).

A1590 - *Searching for CH from Carbon-rich Circumstellar Shells* - Lewis, B. (NAIC).

A1610 - *Radio Frequency Observations of Cometary OH, CH, and H_2CO* - Howell, E., Lewis, B. (NAIC), Schloerb, F. (U. Mass.), Lovell, A. (Agnes Scott), Nolan, M. (NAIC).

A1619 - *Probing Low Temperature and High Density Clouds via 6 cm Formaldehyde Absorption of the CBR* - Evans, N., Mueller, K. (U. Texas), Goldsmith, P. (NAIC).

A1621 - *Mapping of Low Density Sources from the Murphy-Lockman Survey* - Hoffman, G. (Lafayette), Salpeter, E. (Cornell).

A1623 - *The HI Content of Local Luminous Blue Compact Galaxies* - Pisano, D. (Australia), Garland, C., Williams, J., Guzman, R. (U. Florida), Castander, F. (Yale).

A1625 - *Properties of the ISM of a Sample of the Most Isolated Galaxies: Atomic Gas Content* - Verdes-Montenegro, L., Espada, D. (Andalucia).

A1628 - *The Outer Edge of High Velocity Cloud WvV 413* - Hoffman, G. (Lafayette), Salpeter, E. (Cornell).

A1629 - *A Mini Survey for CO Emission at Redshifts Greater Than 10* - Briggs, F. (Kapteyn).

A1632 - *A Blind HI Survey of the Leo I Group* - Flint, K. (Carnegie), Impey, C. (U. Arizona).

A1633 - *The Effect of the Cluster Environment on Galaxy Evolution in the Pegasus I Cluster* - Rose, J., Bartholomew, L. (U. No. Carolina).

A1634 - *The LGS 3 Field: Resolving a Possible Dwarf Spheroidal Interaction* - Robishaw, T., Simon, J. (Berkeley).

A1652 - *The Spatial Distribution of LSNs in the Pisces-Perseus Super Cluster* - Cabanela, J. (Harvard).

A1653 - *A 21-cm Search for Low-z Damped Ly-α Systems towards Compact Radio Sources* - Ghosh, T., Salter, C., O'Neil, K. (NAIC).

A1695 - *The HI Content of Local Luminous Blue Compact Galaxies* - Pisano, D. (Australia), Garland, C., Williams, J., Guzman, R. (U. Florida), Castander, F. (Yale).

A1698 - *CH Emission in Galaxies* - Baan, W. (Westerbork), Hofner, P. (U. Puerto Rico).

A1700 - *A Search for H_2CO in the Cloverleaf Quasar at z=256* - Olmi, L., Hofner, P., Araya, E. (U. Puerto Rico).

A1702 - *A Search for HI Absorption in a High Metallicity DLA at z=2.462* - Kanekar, N. (Kapteyn), Ghosh, T. (NAIC), Chengalur, J. (NCRA).

A1703 - *21-cm Observations of Virgo Cluster Dwarf Spheroidal Galaxies* - Sabatini, S. (Cardiff U.), van Driel, W. (GEPI, Paris), Davies, J. (Cardiff U.), O'Neil, K. (NAIC).

A1704 - *Environments of UCHII Regions: Carbon Recombination Lines as Probes of Ultra-Dense PDRs* - Roshi, A., Goss, W. (NRAO), DePree, C. (Agnes Scott), Balser, D. (NRAO).

A1705 - *A Search for Low Mass HI Clouds in the Local Hubble Volume* - Giovanelli, R., Haynes, M., Darling, J., Masters, K., Spekkens, K., Springob, C. (Cornell).

A1708 - *A Search for CH Emission from Diffuse Molecular Gas* - Magnani, L. (U. Georgia), Chastain, R. (U. Washington), Sass, C. (U. Georgia).

A1709 - *Measuring the Magnetic Field in a Galaxy at z=0.09* - Lane, W. (NRL), Heiles, C., Robishaw, T. (Berkeley).

A1710 - *Reinvestigation of the Top SETI@Home Candidate Signals* - Korpela, E., Werthimer, D. (Berkeley).

A1711 - *Characterizing and Monitoring Time Variability in OH Mega Masers* - Darling, J. (Cornell).

A1713 - *HI Absorption towards Compact Steep Spectrum Radio Sources* - Jeyakumar, S. (Koeln), Sailcia, D. (NCRA), Salter, C., Ghosh, T. (NAIC), Statzki, T. (Koeln).

A1721 - *Further Investigating the Surprising Gas Content of Lenticular Galaxies* - Welch, G., Sage, L. (St. Mary's), Baan, W. (Westerbork).

A1724 - *HI and OH in Damped Lyman-alpha Systems* - Kanekar, N. (Kapteyn), Chengalur, J. (NCRA), Ghosh, T. (NAIC).

A1726 - *Calibration of the SDSS Spectroscopic Line Width Scaling Relations* - Gardner, J. (U. Pitt.), Haynes, M., Giovanelli, R. (Cornell), Connolly, A. (U. Pitt.).

A1728 - *Understanding Molecular Cloud Structure through Observations of Atomic Hydrogen* - Goldsmith, P. (Cornell), Li, D. (Harvard).

A1730 - *High Brightness Temperature Phenomena in Active Stars: Testing the Solar/Stellar Connection* - Osten, R., Bastian, T. (NRAO).

A1731 - *Search for Diffuse Supra-Cluster Synchrotron Emission at 330 and 408 MHz in Part of the Great Wall near the Coma Cluster* - Kronberg, P. (LANL), Salter, C. (NAIC), Perley, R. (NRAO), Kassim, N. (NRL).

A1789 - *OH Maser Survey: A Precursor to a Large Methanol Maser Survey* - Pandian, J., Goldsmith, P. (Cornell).

7.2 Pulsar Radio Astronomy

P1425 - *Timing of Three Recently Discovered Pulsars* - McLaughlin, M. (Cornell), Arzoumanian, Z. (NASA), Cordes, J. (Cornell), Lorimer, D. (NAIC), Chatterjee, S. (Cornell).

P1428 - *Parallax Measurements of PSR J0030+0451* - Lommen, A., Backer, D. (UC-Berkeley).

P1477 - *Multifrequency Timing of PSR B1257+12 and PSR B1534+12* - Wolszczan, A., Bogdanov, S. (Penn. St.).

P1481 - *Probing the Nano-Hertz Gravitational Wave Background with a Pulsar Timing Array* - Backer, D., Lommen, A. (Berkeley), Nice, D., Splaver, E. (Princeton), Stairs, I. (NRAO).

P1509 - *Caltech-Arecibo Drift Survey: Timing of New Pulsars* - Chandler, A., Anderson, S., Kulkarni, S., Prince, T. (Caltech).

P1555 - *Timing of New Pulsars Discovered in the Parkes Multibeam Survey* - Stairs, I. (NRAO), Camilo, F. (Columbia), Hobbs, G., Lyne, A., Kramer, M. (Jodrell Bank).

P1556 - *Deep Pulse Searches of Two Galactic Gamma Ray Sources* - Kaspi, V., Roberts, M., Hessels, J. (McGill), Freire, P. (NAIC).

P1557 - *Probing the Galaxy's Electron Content and Magnetic Field Using Newly Discovered Pulsars* - Bhat, R. (NAIC), Camilo, F. (Columbia), Cordes, J. (Cornell), Lorimer, D. (Jodrell Bank), Nice, D. (Princeton).

P1558 - *Understanding the Emission Geometry of Radio Pulsars* - Gupta, Y., Bhat, R. (NAIC), Gangadhara, R., Ahmadi, P. (IIA, India).

P1566 - *A Search for Gamma-Ray Pulsars* - Freire, P. (NAIC).

P1567 - *High Precison Timing of Pulsars in Globular Clusters* - Freire, P. (NAIC).

P1592 - *Searching for the Radio Counterpart to the Neutron Star in SNR G54.1+0.3* - Camilo, F. (Columbia), Weng, D., Lu, F. (U. Mass.), Bhat, R. (NAIC), Lorimer, D. (Jodrell Bank).

P1594 - *A Search for Bursting Pulsars* - Wolszczan, A., Soltysinski, T., Bogdanov, S. (Penn St.).

P1595 - *Longterm Monitoring of PSR B1534+12* - Stairs, I. (U. Br. Columbia), Thorsett, S. (UCSC), Taylor, J. (Princeton).

P1597 - *New Single-Pulse Observations of Three Strong Pulsars* - Nowakowski, L. (U. Puerto Rico).

P1598 - *Multiwavelength Behavior of Pulsar Scintillation Arcs* - Stinebring, D. (Oberlin), Cordes, J. (Cornell), McLaughlin, M. (Nuffield).

P1600 - *Timing a Millisecond Pulsar in a Long-Period Orbit* - Lorimer, D. (Manchester), Xilouris, K. (U. Virginia), Stairs, I. (NRAO), Fruchter, A. (STScI), Eder, J., Vazquez, A. (NAIC).

P1621 - *Mapping of Low Density Sources from the Murphy-Lockman Survey* - Hoffman, L. (Lafayette), Salpeter, E. (Cornell).

P1636 - *A Complete 1.4 GHz Search for Pulsars in Globular Clusters* - Kaspi, V., Ransom, S., Hessels, S. (McGill), Stairs, I. (NRAO), Freire, P. (NAIC).

P1637 - *Searching for Radio Pulsation from the Neutron Star in SNR G39.2-0.3* - Camilo, F., Olbert, C. (Columbia), Arzoumanian, Z. (Goddard), Kramer, M., Lorimer, D., McLaughlin, M. (Jodrell Bank), Nice, D. (Princeton).

P1638 - *A Search for Giant-Pulse Emission from Pulsars* - Cordes, J. (Cornell), McLaughlin, M. (Jodrell Bank), Bhat, R. (NAIC), Hankins, T., Kern, J. (New Mexico Tech), Romani, R. (Stanford), Johnston, S. (Sydney), Ruderman, M. (Columbia).

P1639 - *Conal Beam Rotation and the Problems of Nulling, Drifting, and Mode Changing* - Rankin, J. (U. Vermont), Hankins, T., Kern, J. (New Mexico Tech), van Leeuwen, J. (Utrecht).

P1640 - *Timing Newly Discovered Millisecond Pulsars* - Ransom, S., Kaspi, V. (McGill), Stairs, I. (NRAO), Hessels, J. (McGill), Lorimer, D. (Jodrell Bank).

P1641 - *Ultra-High Time Resolution Measurements of the Crab Giant Radio Pulses* - Hankins, T., Kern, J., Eilek, J., Weatherall, J. (New Mexico Tech).

P1679 - *A Search for Millisecond Radio Pulsars among Double Degenerate Binaries* - Arzoumanian, Z. (NASA), Napiwotzki, R. (Erlangen-Nurnberg).

P1680 - *Arecibo Observations of SGR 1900+14 during Outburst* - Kaspi, V., Lyatokov, M. (McGill), Kouveliotou, C. (NASA), Ransom, S. (McGill).

P1681 - *Timing Millisecond Pulsars II. The PSR J2016 +1947 Binary System* - Freire, P. (NAIC), Anderson, S. (Caltech).

P1682 - *Confirmation of Pulsar Candidates from 430 MHz Drift-Scan Searches* - McLaughlin, M., Lorimer, D. (Jodrell Bank), Arzoumanian, Z. (NASA), Backer, D. (Berkeley), Cordes, J. (Cornell).

P1683 - *A Deep Search for Radio Pulsars in Two Supernova Remnants* - Lorimer, D. (Jodrell Bank), Camilo, F. (Columbia), McLaughlin, M. (Jodrell Bank), Bhat, R. (NAIC).

P1684 - *Timing Millisecond Pulsars I. The PSR J1738 +0335 Binary System* - Freire, P. (NAIC), Jacoby, B. (Caltech).

P1685 - *Timing of Pulsars Recently Discovered in 430 MHz Drift-Scan Search Data* - Lorimer, D., McLaughlin, M. (Jodrell Bank).

P1686 - *Timing the Newly Discovered 3000-Year-Old Radio and X-ray Pulsar in SNR G54.1+0.3* - Camilo, F. (Columbia), Lorimer, D. (Jodrell Bank), Bhat, R. (NAIC).

P1688 - *Timing and Polarimetry of the Newly Discovered Young Pulsar J2021+3651* - Roberts, M., Hessels, J. (McGill), Freire, P. (NAIC), Kaspi, V., Ransom, S. (McGill).

P1690 - *Timing Newly Discovered Millisecond Pulsars II* - Ransom, S., Kaspi, V. (McGill), Stairs, I. (U. Br. Columbia), Hessels, J. (McGill), Lorimer, D. (Manchester).

P1691 - *Three X-ray Bright Neutron Star Candidates: A Search for Radio Pulsar Counterparts* - Arzoumanian, Z. (NASA), Lorimer, D. (Jodrell Bank), Freire, P. (NAIC), Samar, S. (U. Manitoba), Kothes, R. (Bulent), Landecker, T. (DRAO/NRC).

P1693 - *Pilot Observations for a Drift-Scan Pulsar Search at 327 MHz* - Freire, P. (NAIC), Cordes, J. (Cornell).

P1734 - *Subpulse Fluctuation Properties of Northern Pulsars* - Deshpande, A. (NAIC), Rankin, J. (U. Vermont), McConnell, D. (AINF).

P1735 - *Ultra Wide Bandwidth Observations of the Crab*

Giant Pulses - Hankins, T., Kern, J., Weatherall, J., Eilek, J. (New Mexico Tech).

P1737 - *Relativistic Decay of a Pulsar White-Dwarf Binary* - Nice, D. (Princeton), Stairs, I. (U. Br. Columbia).

P1739 - *Timing Newly Discovered Millisecond Pulsars III. M3* - Ransom, S., Hessels, J. (McGill), Stairs, I. (U. Br. Columbia), Kaspi, V. (McGill), Lorimer, D. (Jodrell Bank).

P1740 - *Long Term Monitoring of PSR J1534+12* - Stairs, I. (U. Br. Columbia), Thorsett, S. (UCSC), Taylor, J. (Princeton).

P1741 - *PSR N1534+12: Campaign Observations* - Stairs, I. (U. Br. Columbia), Thorsett, S. (UCSC), Taylor, J. (Princeton).

P1743 - *Pilot Studies for Arecibo Multibeam Pulsar Surveys* - Camilo, F. (Columbia), Cordes, J. (Cornell), Arzoumanian, Z. (NASA), Freire, P. (NAIC), Lorimer, D., McLaughlin, M. (Jodrell Bank), Stairs, I. (U. Br. Columbia), Ramachandran, K. (Berkeley).

P1745 - *Investigation of Mode Switching Phenomenon in Single Component Pulsars* - Nowakowski, L. (U. Puerto Rico), Bhat, R. (MIT).

P1770 - *Relativistic Measurements of Binary Pulsar B1913+16* - Taylor, J. (Princeton), Weisberg, J. (Carleton).

P1774 - *Confirmation of Pulsars with Possible EGRET Associations* - Roberts, M., Hessels, J., Ransom, S., Livingstone, M., Kaspi, V. (McGill).

7.3 Radar Astronomy

R1605 - *Completing the Radar Survey of Fifty Mainbelt Asteroids* - Magri, C. (U. Maine), Nolan, M. (NAIC), Ostro, S., Giorgini, J., Yeomans, D. (JPL).

R1643 - *Radar Imaging of Asteroid J604 (1992 FE)* - Benner, L., Ostro, S. (JPL), Nolan, M. (NAIC), Margot, J.-L. (Caltech), Giorgini, J. (JPL).

R1644 - *Radar Imaging of Asteroids 15 Eunomia and 25 Phocaea in 2002* - Magri, C. (U. Maine), Nolan, M. (NAIC), Ostro, S., Giorgini, J., Yeomans, D. (JPL).

R1645 - *Radar Observations of Near-Earth Asteroid 2002 AL14 in July 2002* - Nolan, M., Hine, A., Howell, E. (NAIC), Campbell, D. (Cornell), Benner, L., Ostro, S. (JPL), Margot, J-L. (Caltech).

R1654 - *Proposal for Radar Observations of Asteroid 2002 AA29* - Ostro, S., Chodas, P., Benner, L. (JPL), Nolan, M. (NAIC), Giorgini, J. (JPL), Margot, J.-L. (Caltech).

R1665 - *Radar Observations of Near-Earth Asteroid 2002 HK12 in August 2002* - Nolan, M., Howell, E. (NAIC), Campbell, D. (Cornell), Benner, L., Ostro, S. (JPL), Margot, J.-L. (Caltech).

R1666 - *Radar Imaging of Near-Earth Asteroid 22753 (1998 WT)* - Benner, L. (JPL), Nolan, M. (NAIC), Ostro, S., Giorgini, J. (JPL), Margot, J.-L. (Caltech).

R1667 - *Proposal for Radar Observations of Near-Earth Asteroid 1993 OM7* - Ostro, S. (JPL), Nolan, M. (NAIC), Benner, L., Giorgini, J. (JPL), Margot, J.-L. (Caltech).

R1668 - *S-Band Radar Observations of Iapetus* - Black, G. (NRAO), Campbell, D., Carter, L. (Cornell), Ostro, S. (JPL).

R1669 - *S-Band Radar Mapping of Saturn's Rings* - Nicholson, P. (Cornell), French, R. (Wellesley), Campbell, D. (Cornell), Black, G. (NRAO), Margot, J.-L. (Caltech).

R1670 - *Radar Imaging of Asteroids 46 Hestia, 109 Felicitas, and 20 Massalia in 2002* - Magri, C. (U. Maine), Nolan, M. (NAIC), Ostro, S., Giorgini, J. (JPL).

R1672 - *Radar Observations of Near-Earth Asteroid CQ11 in January 2003* - Nolan, M., Hines, A., Howell, E. (NAIC), Ostro, S. (JPL), Margot, J.-L. (Caltech).

R1673 - *S-Band Radar Observations of Titan* - Campbell, D. (Cornell), Black, G. (NRAO), Carter, L. (Cornell), Ostro, S. (JPL).

R1714 - *Radar Observations of Asteroid 2991 EB18* - Nolan, M. (NAIC), Margot, J.-L. (Caltech), Howell, E. (NAIC), Ostro, S., Benner, L., Giorgini, J. (JPL), Campbell, D. (Cornell), Black, G. (NRAO).

R1715 - *Radar Observations of Asteroid 2002 NY40* - Campbell, D. (Cornell), Margot, J.-L. (Caltech), Nolan, M. (NAIC), Ostro, S., Benner, L. (JPL).

R1716 - *Radar Observations of Comet 2002 O6* - Nolan, M., Harmon, J. (NAIC).

R1718 - *Radar Observations of Asteroid 4 Vesta* - Nolan, M. (NAIC), Magri, C. (U. Maine), Howell, E. (NAIC), Campbell, D. (Cornell), Ostro, S. (JPL), Margot, J.-L. (Caltech), Benner, L., Giorgini, J. (JPL).

R1719 - *Test of the Yarkovsky Effect Using Radar Ranging to Golevka* - Ostro, S., Chesley, S., Giorgini, J., Benner, L. (JPL), Margot, J.-L. (Caltech).

R1746 - *Radar Imaging of Near-Earth Asteroid 5381 Sekhmet* - Nolan, M., Howell, E. (NAIC), Benner, L., Ostro, S., Giorgini, J. (JPL), Margot, J.-L. (Caltech).

R1780 - *Radar Imaging of Near-Earth Asteroids 1998 FH12, 22771 (1999 CU3), and 1998 RO1* - Benner, L. (JPL), Nolan, M. (NAIC), Ostro, S., Giorgini, J. (JPL), Margot, J.-L. (Caltech), Pravec, P. (Czech), Brown, P. (U. W. Ontario).

R1781 - *High Resolution 70-cm Radar Imaging of the Lunar South Pole: Searching for Evidence of Ice* - Campbell, B. (Smithsonian), Campbell, D. (Cornell).

R1792 - *Radar Observations of 2003 GF21* - Howell, E., Nolan, M. (NAIC).

7.4 VLBI

NO2L3 - *Network VLBI* - Paragi, Z. (JIVE, Neth.)
GM047 - *Network VLBI* - Marcaide, J. (U. Valencia)
ED018 - *Network VLBI* - Desmurs, J.-F. (Cornell).
GL026 - *Network VLBI* - Lonsdale, C. (Haystack).
BS116 - *Network VLBI* - Slysh, V. (ASC, Moscow)
BM176 - *Network VLBI* - Momjian, E. (NAIC)
BC134 - *Network VLBI* - Chatterjee, S. (Cornell)
ED018 - *Network VLBI* - Desmurs, J.-F. (OAN)
CL03M1 - *Network VLBI* - Paragi, Z. (JIVE, Neth.)
BT69 - *Network VLBI* - Taylor, G. (NRAO)

7.5 Special

S1145 - *Project Phoenix: SETI Targeted Search Observations* - Tarter, J. (SETI Inst.).

S1662 - *Summer Student's (2002) Hands-on Observing* - Bhat, R. (NAIC).

PUBLICATIONS

The following is a list of publications by NAIC staff or by outside users of the Arecibo telescope. These contributions appeared in the open literature or were in press during the period from July, 2002 through June, 2003.

Altschuler, D.R., 2002, ''The National Astronomy and Ionosphere Center's (NAIC) Arecibo Observatory in Puerto Rico,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Araya, E., Hofner, P., Churchwell, E., Sewilo, M., Watson, C., Linz, H., & Kurtz, S., 2002, ''H_2CO 6 cm Emission toward IRAS 18566+0408,'' BAAS, 34, 1230.

Backus, P.R., & The Project Phoenix Team, 2002, ''Project Phoenix: SETI Observations from 1200 to 1750 MHz with the Upgraded Arecibo Telescope,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Benedettini, M., Viti, S., Giannini, T., Nisini, B., Goldsmith, P.F., & Saraceno, P., 2002, ''Comparing SWAS and ISO Observations of Water in Outflows,'' A&A, 395, 657.

Benner, L.A.M., Ostro, S.J., Hudson, R.S., Rosema, K.D., Jurgens, R.F., Yeomans, D.K., Campbell, D.B., Chandler, J.F., & Shapiro, I.I., 2002, ''Radar Observations of Asteroid 3908 Nyx,'' Icarus, 158, 379.

Bergmann, M.P., Jorgensen, I., & Hill, G.J., 2003, ''Spectroscopy of Low Surface Brightness Galaxies with the Hobby-Eberly Telescope,'' AJ, 125, 116.

Bhat, N.D.R., Camilo, F., Cordes, J.M., Nice, D., Lorimer, D.R., & Chatterjee, S., 2002, ''Arecibo Observations of Parkes Multi-beam Pulsars,'' J. Astrophys. Astron., 23, 53.

Bhat, N.D.R., Cordes, J.M., & Chatterjee, S., 2003, ''A CLEAN-based Method for Deconvolving Interstellar Pulse Broadening from Radio Pulses,'' ApJ, 584, 782.

Black, G.J., Campbell, D.B., Carter, L.M., & Ostro, S.J., 2002, ''Radar Detection of Iapetus,'' BAAS, 34, 882.

Bogdanov, S., Pruszynska, M., Lewandowski, W., & Wolszczan, A., 2002, ''Interstellar Scintillation Velocities of a Relativistic Binary PSR B1534+12 and Three Other Millisecond Pulsars,'' ApJ, 584, 495.

Boyer, M.L., & Gupta, Y., 2002, ''A Study of the Pulsar Emission Region at Multiple Frequencies,'' BAAS, 34, 1298.

Cabanela, J.E., & Dickey, J.M., 2002, ''Galaxies on the Blue Edge,'' AJ, 124, 78.

Cabanela, J., & Roscioli, M., 2002, ''The Distribution of Low Surface Brightness Galaxies in the Pisces-Perseus Supercluster,'' BAAS, 34, 1121.

Camilo, F., Lorimer, D.R., Bhat, N.D.R., Gotthelf, E.V., Halpern, J.P., Wang, Q.D., Lu, F.J., & Mirabal, N., 2002, ''Discovery of a 136 Millisecond Radio and X-ray Pulsar in Supernova Remnant G54.1+0.3,'' ApJL, 574, L71.

Campbell, B.A., Campbell, D.B., & Nolan, M., 2003, ''New High-Resolution 70-cm Wavelength Radar Images of the Moon,'' Lunar Planet. Sci. Conf. 34th, abstract #1700.

Campbell, D.B., Black, G.J., Carter, L.M., & Ostro, S.J., 2002, ''The Surface of Titan: Arecibo Radar Observations in 2001,'' BAAS, 34, 879.

Campbell, D.B., 2002, ''Measurement in Radio Astronomy,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Campbell, D.B., Hudson, R.S., & Margot, J.L., 2002, ''Advances in Planetary Radar Astronomy,'' in *Review of Radio Science 1999-2002*, ed. W. Stone (John Wiley & Sons).

Carter, L.M., Campbell, D.B., Campbell, B.A., & Margot, J.-L., 2003, ''Searching for Surficial Deposits on Venus Using Multi-Polarization Radar,'' Lunar Planet. Sci. Conf. 34th, abstract #1809.

Chomiuk, L., Stanimirovic, S., Salter, C., Bhat, R., Urosevic, D., & Lorimer, D., 2002, ''Arecibo Grasps a Possible Interaction Between SNR G42.8+0.6 and a Molecular Cloud,'' Am. Astron. Soc. Mtg. 201st, abstract #143.02.

Cordes, J.M., 2002, ''Pulsar Observations I. Propagation Effects, Searching Distance Estimates, Scintillations and VLBI,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Darling, J., & Giovanelli, R., 2002, ''A Search of OH Megamasers at $Z > 0.1$. III. The Complete Survey,'' AJ, 124, 100.

Darling, J., Goldsmith, P.F., Li, D., & Giovanelli, R., 2003, ''A Search for 6.7 GHz Methanol Masers in OH Megamaser Galaxies at $0.11 < z < 0.27$,'' AJ, 125, 1177.

Deshpande, A.A., 2002, ''From Pulsar Radio Pulse Sequences to Pulsar Polar-Cap Weather,'' Conf. Proc. Vikram Sarabhai Research Award Lecture, Physical Research Laboratory, Ahmedabad.

Finley, D.G., Alonso, J.L., Altschuler, D., Cianciolo, F., Cuesta, L., Harrison, R., Hemenway, M.K., Michaud, P., Morison, I., Preston, S., Rijsdjk, C., Teays, T., West, R.M., & Wetzel, M., 2002, ''The STate of the ARt Telescope Educational Collaboration (STARTEC),'' BAAS, 34, 1108.

Ford, K.E.S., Neufeld, D.A., & Goldsmith, P.F., 2003, ''Detection of OH Towards the Extreme Carbon Star IRC +10216,'' ApJ, 589, 430.

Freire, P.C., Camilo, F., Kramer, M., Lorimer, D.R., Lyne, A.G., Manchester, R.N., & D'Amico, N., 2003, ''Further Results from the Timing of the Millisecond Pulsars in 47 Tucanae,'' MNRAS, 340(4), 1359.

Ghosh, T., 2002, ''Spectrum Management,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Ghosh, T., & Salter, C., 2002, ''Arecibo Spectral Baselines in the Presence of Continuum Emission,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Giorgini, J.D., Ostro, S.J., Benner, L.A.M., Chodas, P.W., Chesley, S.R., Hudson, R.S., Nolan, M.C., Klemola, A.R., Standish, E.M., Jurgens, R.F., Rose, R., Chamberlin, A.B., Yeomans, D.K., & Margot, J.-L., 2002, ''Asteroid 1950 DA's Encounter with Earth in 2880: Physical Limits of Collision Probability Prediction,'' BAAS, 34, 934.

Goldsmith, P.F., 2002, ''Radio Telescopes and Measurements at Radio Wavelengths,'' in *Single-Dish Radio As-*

tronomy: Techniques and Applications, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Goldsmith, P.F., Li, D., Bergin, E.A., Melnick, G.J. Tolls, V., Howe, J.E., Snell, R.L., & Neufeld, D.A., 2002, ''Tentative Detection of Molecular Oxygen in the Rho Ophiuchi Cloud,'' ApJ, 576, 814.

Gupta, Y., & Gangadhara, R.T., 2003, ''Understanding the Radio Emission Geometry of Multiple-Component Radio Pulsar from Retardation and Aberration Effects,'' ApJ, 584, 418.

Hankins, T.H., 2003, ''Nanosecond Radio Bursts from Strong Plasma Turbulence in the Crab Pulsar,'' Nature, 422, 141.

Harmon, J.K., 2002, ''Planetary Delay-Doppler Radar and the Long-Code Method,'' IEEE Trans. Geosci. Rem. Sens., 40, 1904.

Heiles, C., 2002, ''A Heuristic Introduction to Radioastronomical Polarization,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Heiles, C., & Troland, T.H., 2003, ''The Millennium Arecibo 21-cm Absorption Line Survey. I. Techniques and Gaussian Fits,'' ApJS, 145, 329.

Heiles, C., & Troland, T.H., 2003, ''The Millennium Arecibo 21-CM Absorption Line Survey. II. Properties of the Warm and Cold Neutral Media,'' ApJ, 586, 1067.

Helton, L.A., & Slysh, V.I., 2002, ''All-Stokes Survey of OH Masers in Star Forming Regions: Search for Possible Zeeman Splitting,'' BAAS, 34, 1261.

Hessels, J.W.T., Ransom, S.M., Stairs, I.H., Kaspi, V.M., Backer, D., Freire, P.C.C., & Lorimer, D.R., 2003, ''An L-band Search for Pulsars in Globular Clusters with the Arecibo and Green Bank Telescopes,'' Am. Astron. Soc. HEAD Mtg. 35th, abstract #14.04.

Hoffman, G.L., Salpeter, E.E., & Pocceschi, M.G., 2002, ''High Velocity Cloud Edges and Mini-High-Velocity Clouds,'' ApJ, 576, 232.

Hofner, P., Delgado, H., Whitney, B., Churchwell, E., & Linz, H., 2002, ''X-Ray Detection of the Ionizing Stars in Ultracompact HII Regions,'' ApJL, 579, L95.

Hudson, R.S., Ostro, S.J., & Scheeres, D.J., 2003, ''High-resolution Model of Asteroid 4179 Toutatis,'' Icarus, 161, 346.

Janches, D., Nolan, M.C., Meisel, D.D., Mathews, J.D., Zhou, Q.H., Moser, D.E., 2002, ''On the Geocentric Micrometeor Velocity Distribution,'' J. Geophys. Res., 108, SIA 1-1.

Janches, D., Meisel, D.D., Nolan, M.C., Bartlett, B.D., Mathews, J.D., Zhou, Q.H., Moser, D.E., 2003, ''Orbital Properties of Micron-Size Dust Determined Using the Arecibo 430 MHz Dual-Beam Radar,'' in *Astrophysics of Dust*, ed. A. Witt (Estes Park, CO).

Karastergiou, A., Kramer, M., Johnston, S., Lyne, A.G., Bhat, N.D.R., & Gupta, Y., 2002, ''Simultaneous Single-Pulse Observations of Radio Pulsars: II. Orthogonal Polarization Modes in PSR B1133+16,'' A&A, 391, 247.

Konacki, M., Wolszczan, A., & Stairs, I., 2003, ''Geodetic Precession and Timing of the Relativistic Binary Pulsars PSR B1534+12 and PSR B1913+16,'' ApJ, 589, 495.

Konacki, M., & Wolszczan, A., 2003, ''Earth-size Planets in the PSR B1257+12 Planetary System,'' Am. Astron. Soc. Mtg. 202nd, abstract #55.03.

Lewis, B.M., 2002, ''On Dead OH/IR Stars,'' ApJ, 576, 445.

Lewis, B.M., 2002, ''Observational Evidence for an Abrupt Decrease in the Mass-Loss Rate of FV Boo,'' BAAS, 34, 1146.

Lewis, B.M., 2002, ''On the Life and Death of OH/IR Stars,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Lewis, B.M., 2003, ''2MASS Data Shows That Most Red Arecibo OH/IR Stars Have Detached Shells,'' Am. Astron. Soc. Mtg. 202nd, abstract #32.19.

Li, D., & Goldsmith, P.F., 2003, ''HI Narrow Line Absorption in Dark Clouds,'' ApJ, 585, 823.

Li, D., Goldsmith, P.F., & Menten, K., 2003, ''Massive Quiescent Cores in Orion I: Temperature Structure,'' ApJ, 587, 262.

Lockman, F.J., 2002, ''Stray Radiation: Causes, Curses, and Cures,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Lommen, A.N., 2002, ''New Limits on Gravitational Radiation Using Pulsars,'' in *Proc. WE-Heraeus Seminar on Neutron Stars, Pulsars and Supernova Remnants*, eds. W. Becker *et al.*

Lommen, A.N., 2003, ''Precision Multi-Telescope Timing of Millisecond Pulsars: New Limits on the Gravitational Wave Background and Other Results from the Pulsar Timing Array,'' PhD. Thesis, University of California, Berkeley.

Lovell, A.J., Howell, E.S., & Schloerb, F.P., 2002, ''Spectral Line Mapping Observations of 18-cm OH Lines in Comets,'' BAAS, 34, 869.

Lovell, A.J., Howell, E.S., Schloerb, F.P., Lewis, B.M., & Hine, A.A., 2002, ''Arecibo Observations of the 18 cm OH Lines of Six Comets,'' in *Proc. Asteroids, Comets, Meteors Conf. 2002*, ESA SP-500, ed. B. Warmbein (ESA).

Magnani, L., McCarthy, M., Sandin-Alvarez, R., & Chastain, R., 2002, ''The HI Environment of MBM40,'' BAAS, 34, 1283.

Magri, C., Nolan, M.C., Ostro, S.J., & Giorgini, J.D., 2002, ''Radar Imaging of Asteroid 654 Zelinda,'' in *Proc. Asteroids, Comets, Meteors Conf. 2002*, ESA SP-500, ed. B. Warmbein (ESA).

Mantovani, F., Bondi, M., Saikia, D.J., Junor, W., Salter, C.J., & Ricci, R., 2003, ''Two-Sided Radio Jets in B1524-136,'' in *Third Workshop on Compact Steep Spectrum and GHz-Peaked Spectrum Radio Sources*, Publ. Astr. Soc. Australia, 20, 85.

Mantovani, F., Junor, W., Saikia, D.J., & Salter, C.J., 2003, ''The Polarized Gently Bent Jet of 3C43,'' in *Third Workshop on Compact Steep Spectrum and GHz-Peaked Spectrum Radio Sources*, Publ. Astr. Soc. Australia, 20, 123.

Mantovani, F., Junor, W., Ricci, R., Saikia, D.J., Salter, C., & Bondi, M., 2002, ''Milli-arcsecond Scale Rotation

Measure in the CSS Quasars 0548+165 and 1524-136,'' A&A, 389, 58.

Mantovani, F., Saikia, D.J., Bondi, M, Junor, W., Salter, C.J., & Ricci, R., 2002, ''B1524-136: A. CSS Quasar with Two-Sided Radio Jets,'' A&A, 389, L15.

Mathews, J.D., Doherty, J., Wen, C.-H., Janches, D., Meisel, D.D., 2002, ''Meteor Science Issues Addressed via UHF Radar Meteor Observations at Arecibo Observatory,'' in *Proc. Asteroids, Comets, Meteors Conf. 2002*, ESA SP-500, ed. B. Warmbein (ESA).

McLaughlin, M.A., Lorimer, D.R., Arzoumanian, Z., Backer, D.C., Cordes, J.M., Fruchter, A., Xilouris, K., & Lommen, A.N., 2002, ''New Pulsars from Arecibo Drift-Scan Searches,'' to appear in *Radio Pulsars*, eds. M. Bailes *et al.* (ASP).

Meisel, D.D., Janches, D., Mathews, J.D., 2003, ''Nearby Stars as Sources of Arecibo Radar Detected Interstellar Dust Particles,'' in *Astrophysics of Dust*, ed. A. Witt (Estes Park, CO).

Meisel, D.D., Janches, D., Mathews, J.D., 2002, ''The Size Distribution of Arecibo Interstellar Particles and Its Implications,'' ApJ, 579, 895.

Mitra, D., & Rankin, J.M., 2002, ''Toward an Empirical Theory of Pulsar Emission. VII. On the Spectral Behavior of Conal Beam Radii and Emission Heights,'' ApJ, 577, 322.

Molotov, I., Chuprikov, A., Likhachev, S, Salter, C., Ghosh, T., Ghigo, F., & Dougherty, S., 2002, ''First VLBI Observations with Arecibo in an International S2 Ad-hoc Array,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Monnier-Ragaigne, D., van Driel, W, Balkowski, C., Schneider, S., Jarrett, T.H., & O'Neil, K., 2002, ''A Study of 2Mass Low Surface Brightness Galaxies,'' in *The Evolution of Galaxies II - Basic Building Blocks* (Khaver Academic).

Neufeld, D.A., Kaufman, M.J., Hollenbach, D.J., Goldsmith, P.F., & Plume, R., 2002, ''Submillimeter Wave Astronomy Satellite and Arecibo Observations of H2O and OH in a Diffuse Cloud Along the Line of Sight to W51,'' ApJ, 580, 278.

Nice, D.J., Splaver, E.M., & Stairs, I.H., 2002, ''Neutron Star Masses from Arecibo Timing Observations of Five Pulsar-White Dwarf Binary Systems,'' to appear in *Radio Pulsars*, eds. M. Bailes *et al.* (ASP).

Nicholson, P.D., Campbell, D.B., French, R.G., Margot, J.L., Black, G.J., & Nolan, M., 2002, ''Radar Imaging of Saturn's Rings,'' BAAS, 34, 883.

Nowakowski, L.A., Bhat, N.D.R., & Lorimer, D.R., 2002, ''Arecibo Single-Pulse Studies of PSR B0950+08: Inter Pulse and Bridge Emissions,'' BAAS, 34, 1297.

O'Neil, K., 2002, ''Single-Dish Calibration Techniques at Radio Wavelengths,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

O'Neil, K., Eder, J., Bothun, G., & Schombert, J., 2002, ''Exploring the Sensitivity Limit: 21 cm Observations of Low Surface Brightness Galaxies with the Arecibo Telescope,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

O'Neil, K., Schinnerer, E., & Hofner, P., 2003, ''Further Discoveries of 12CO in Low Surface Brightness Galaxies,'' ApJ, 588, 230.

Rankin, J.M., Suleymanova, S.A., & Deshpande, A.A., 2003, ''The Topology and Polarization of Sub-beams Associated with the Drifting Subpulse Emission of Pulsar B0943+10 - III. Analysis of Pushchino 103/40-MHz Observations,'' MNRAS, 340, 1076.

Ransom, S.M., Hessels, J.W.T., Stairs, I.H., Kaspi, V.M., Backer, D.C., Greenhill, L.J., & Lorimer, D.R., 2002, ''Recent Globular Cluster Searches with Arecibo and the Green Bank Telescope,'' to appear in *Radio Pulsars*, eds. M. Bailes *et al.* (ASP).

Rivkin, A.S., Howell, E.S., Vilas, F., & Lebofsky, L.A., 2003, ''Hydrated Minerals on Asteroids: The Astronomical Record,'' in *Asteroids III*, eds. W. Bottke *et al.* (Arizona).

Rivkin, A.S., Binzel, R.P., Howell, E.S., Bus, S.J., & Grier, J.A., 2002, ''Spectroscopy and Classification of Mars Trojan Asteroids,'' BAAS, 34, 840.

Rivkin, A.S., Howell, E.S., Bus, S.J., Hicks, M., Reach, W.T., Jarrett, T.H., & Binzel, R.P., 2003, ''Spectroscopy and Photometry of the Earth Grazer 2002 NY40,'' Lunar Planet. Sci. Conf. 34th, abstract #1722.

Roberts, M.S.E., Hessels, J.W.T., Ransom, S.M., Kaspi, V.M., Freire, P.C.C., Crawford, F., & Lorimer, D.R., 2002, ''PSR J2021+3651: A Young Radio Pulsar Coincident with an Unidentified EGRET Gamma Ray Source,'' ApJL, 577, L19.

Robishaw, T., Simon, J.D., & Blitz, L., 2002, ''HI Imaging of LGS 3 and an Apparently Interacting High-Velocity Cloud,'' ApJL, 580, L129.

Rosenberg, J.L., & Schneider, S.E., 2003, ''The Contribution of HI-Rich Galaxies to the Damped Ly-α Absorber Population at $z = 0$,'' ApJ, 585, 256.

Rosenberg, J.L., & Schneider, S.E., 2003, ''The Contribution of HI-rich Galaxies to the Damped Lyman-alpha Absorber Population at $z = 0$,'' in *The IGM-Galaxy Connection: The Distribution of Baryons at $z = 0$*, ASSL Conf. Proc., 281, ed. J. Rosenberg and M. Putman (Kluwer Academic).

Saikia, D.J., Thomasson, P., Spencer, R.E., Mantovani, F., Salter, C.J., & Jeyakumar, S., 2002, ''CSSs in a Sample of B2 Radio Sources of Intermediate Strength,'' A&A, 391, 149.

Saikia, D.J., Jeyakumar, S., Mantovani, F., Salter, C.J., Spencer, R.E., Thomasson, P., & Wiita, P.J., 2003, ''Symmetry Parameters of CSS Sources: Evidence of Fuelling?,'' Publ. Astron. Soc. Australia, 20(1), 50.

Salter, C.J., 2002, ''Continuum 2: Specific Applications,'' in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Salter, C.J., 2002, ''Single-Dish Radio Telescopes of the World,'' in *Single-Dish Radio Astronomy: Techniques* *and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Salter, C.J., Jeyakumar, S., Saikia, D.J., Ghosh, T., & Stutzki, J., 2003, ‘‘HI Absorption Towards Compact Steep Spectrum Radio Sources,’’ Am. Astron. Soc. Mtg. 202nd, abstract #42.10.

Salzer, J.J., Rosenberg, J.L., Weisstein, E.W., Mazzarella, J.M., & Bothun, G.D., 2002, ‘‘An HI Survey of Actively Star-forming Dwarf Galaxies,’’ AJ, 124, 191.

Smoker, J.V., Haffner, L.M., Keenan, F.P., Davies, R.D., & Pollacco, D., 2002, ‘‘Multiwavelength Observations of the M15 Intermediate-Velocity Cloud,’’ MNRAS, 337(2), 385.

Solanes, J.M., Sanchis, T., Salvador-Sol, E., Giovanelli, R., & Haynes, M.P., 2002, ‘‘The Three-dimensional Structure of the Virgo Cluster Region from Tully-Fisher and HI Data,’’ AJ, 124, 2440.

Splaver, E.M., Nice, D.J., Arzoumanian, Z., Camilo, F., Lyne, A.G., & Stairs, I.H., 2002, ‘‘Probing the Masses of the PSR J0621+1002 Binary System through Relativistic Apsidal Motion,’’ ApJ, 581, 509.

Stairs, I.H., Thorsett, S.E., Taylor, J.H., & Wolszczan, A., 2002, ‘‘Studies of the Relativistic Binary Pulsar PSR B1534+12: I. Timing Analysis,’’ ApJ, 581, 501.

Stairs, I.H., 2002, ‘‘Pulsar Observations II.- Coherent Dedispersion Polarimetry, and Timing,’’ in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Stanimirovic, S., Dickey, J.M., Krco, M., & Brooks, A.M., 2002, ‘‘The Small-Scale Structure of the Magellanic Stream,’’ ApJ, 576, 773.

Stanimirovic, S., Staveley-Smith, L., Jones,. P.A., van der Hulst, J.M., Bontekoe, Tj.R., & Kester, D.J.M., 2002, ‘‘What is Cool about Cool Gas and Dust in the Small Magellanic Cloud?,’’ in *Proc. 3rd Guillermo Haro Astrophysics Conference on Cosmic Evolution and Galaxy Formation*, eds. J. Franco *et al.* (ASP).

Stanimirovic, S., Dickey, J.M., Weisberg, J.M., de la Fuente, A., Devine, K., & Hedden, A., 2002, ‘‘PSR B1849+00 Probes the Tiny-Scale Molecular Gas?,’’ BAAS, 34, 1280.

Stanimirovic, S., 2002, ‘‘Short-Spacings Correction from the Single-Dish Perspective,’’ in *Single-Dish Radio Astronomy: Techniques and Applications*, ASP Conf. Proc., 278, eds. S. Stanimirovic *et al.* (ASP).

Stevenson, S.L., Hunt, L.K., Ghosh, T., & Eder, J., 2002, ‘‘HI Evolutionary Studies of IR-Selected AGN,’’ BAAS, 34, 1192.

van Driel, W., O’Neil, K., Cayatte, V., Duc, P.-A., Dickey, J.M., Balkowski, C., Hernandez, H., Iglesias-Paramo, J., Papaderos, P., Vilchez, J.M., & Thuan, T.X., 2003, ‘‘Non-confirmation of Reported HI Clouds Without Optical Counterparts in the Hercules Cluster,’’ A&A, 399, 433.

Watson, C., Araya, E., Sewilo, M., Churchwell, E., Hofner, P, & Kurtz, S., 2003, ‘‘Resolution of Distance Ambiguities of Inner Galaxy Massive Star Formation Regions. I.,’’ ApJ, 587, 714.

Wilcox, R.E., O’Neil, K., & Eder, J. A., 2002, ‘‘New Standard Catalog of Arecibo HI Observations,’’ BAAS, 34, 1193.

John Harmon