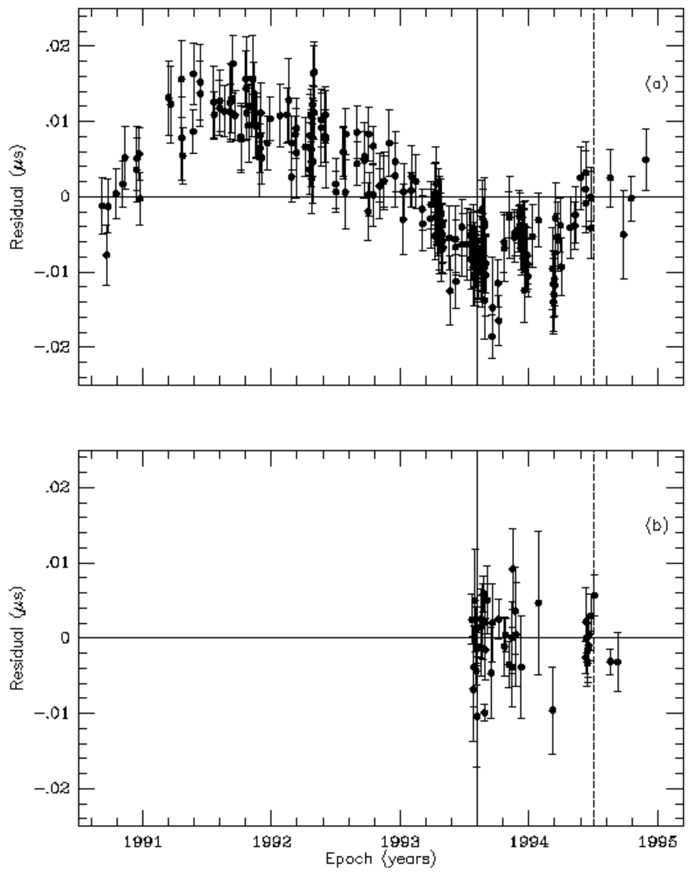

Figure 4. Timing residuals for (a) PSR B1257+12 and (b) PSR J1640+2224 at 430 MHz after subtracting the best-fit models. The solid and dashed vertical lines mark the beginning of the upgrade period and the installation of the PSPM (Penn State Pulsar Machine) at Arecibo, respectively.

minimal impact upon normal Arecibo operations. A dedicated receiver, including fixed point feeds (suspended on the telescope catwalk), low-noise preamplifiers, RF and IF filters and mixers, and a custom-designed power-accumulating FFT spectrometer with 10-kHz resolution and 32-MHz instantaneous bandwidth, was installed at the observatory in 1994 and is presently "on the air." The equipment is interfaced to an autonomous control PC that logs the data to disk and, once a day, spools to a 2-GByte digital audio tape (DAT). The tapes are shipped periodically to Cambridge (there is too much data for an electronic transfer to be practical). Initial analysis showed the system noise temperature and RFI levels to be unexpectedly high. The high system temperature is due primarily to ground spillover (the feed beam-pattern and location is somewhat non-optimal), secondarily to lossy elements (bandpass filters and cables) before the first low-noise gain stage.

Very-low-loss cables and filters have now been installed in the system front end. Currently, the feeds are being redesigned in an effort to reduce ground spillover and horizon sidelobe levels. Through numerical modeling of a point feed asymmetrically illuminating the Arecibo dish, feed design criteria for maximum sensitivity have been identified. Alternative new feed designs are being checked out first by computer simulation. After identifying the most promising of these, scale models are being built and the predicted performance then verified by direct measurement on a test range. Further experimentation with the scale models includes adding slight modifications (such as ground screens and other types of baffles) in an effort to reduce the sidelobe levels still further. It is hoped that these efforts will lead to a feed design which will mitigate the high levels of RFI currently being experienced.

Though gross changes in the 1612-MHz spectra of OH/IR stars are rare, as they steadily lose mass to interstellar space for 10,000 yr, large changes may occur rather quickly during a brief period after mass-loss stops. New observations by B.M. Lewis (NAIC) of 19114+0002 and IRC+10420 provide temporal data linking them to this stage. A rapid, decade-long, increase (IRC+10420) or decrease (OH5.89-0.39) in 1612-MHz intensity suggests that such changes are sequential phases in the terminal evolution of a shell. This is now supported by a modest weakening in the peak intensity of 19114+0002 over the last 5 yr, at the same time as its 1667-MHz peak intensity increased by 50%, so that it is now much the stronger. These portents probably herald an imminent precipitous decline of the 1612-MHz peak, which would confirm 19114+0002 as the missing link in the sequence. There are two further unprecedented changes in spectra of IRC+10420, where the most prominent feature for 15 yr has been an intensity ratio between the strongest blue and red peaks of > 10. Over the last 4 yr this has changed to a ratio of just 2.2. In a parallel development, the velocity range of the 1612-MHz masers has increased by 8%, suggesting that the masers are embedded in a symmetrically accelerating circumstellar shell. This accords with the possibility that IRC+10420 is a hyper-massive star of ~ 100 M_o, like η-Carina, that sheds mass episodically.

The Scientific Staff at Arecibo

To familiarize our readers with the people who work for NAIC, we begin a series of profiles of the various personnel groups within the organization. In this issue we cover the AO scientific staff and their research interests.

Atmospheric Sciences

Paul Castleberg (Graduate student): Doppler Rayleigh and resonance lidar development - Stratosphere and troposphere dynamics studies using lidar and radar.

John Cho (Research Associate): Middle and lower atmosphere dynamics - Physics of atmospheric radar scatter - Noctilucent (polar mesospheric) clouds - Tropical convective storms.

Jonathan Friedman (Research Associate): Application of advanced laser and spectroscopic techniques to lidar studies of the atmosphere.

Raúl Garcia (Technician): Technical support for instrumentation used for atmospheric research including radar and optics.

Sixto González (Research Associate): Studies of the composition and dynamics of the topside ionosphere using radar, satellite, and simulation - Incoherent scatter radar techniques.

Brett Isham (Research Associate): HF ionospheric modification - Incoherent-scatter plasma line diagnostics of the natural ionosphere - Radio and radar techniques for atmospheric research.

Susan Nossal (Research Associate): Optical spectroscopy techniques for atmospheric observations - Exospheric hydrogen observations and their relationship to methane production in the troposphere - Differential absorption lidar measurements of lower atmospheric chemical species.

Michael Sulzer (Head of Ionospheric Modification Group, Senior Research Associate): HF ionospheric modification - Radar techniques - Natural ionosphere studies using incoherent scatter radar.

Craig Tepley (Head of Atmospheric Sciences Group, Senior Research Associate): Doppler Rayleigh lidar studies of lower and middle atmosphere dynamics - Resonance fluorescence lidar observations of atmospheric composition.

Photo by Tony Acevedo.

From left to right: Jonathan Friedman, Brett Isham, Mike Sulzer, John Cho, Susan Nossal, Sixto González, Qihou Zhou, Bob Zimmerman, Craig Tepley.

Qihou Zhou (Research Associate): Ionospheric dynamics and other phenomena - Meteor studies with the 430-MHz radar.

Radar Astronomy

John Harmon (Assistant Director, Arecibo Observatory; Senior Research Associate): Planetary radar astronomy - Topography and surface properties of terrestrial planets and comets - Interplanetary medium (solar wind, solar corona).

Alice Hine (Data Analyst): Planetary radar - Software development.

Michael Nolan (Research Associate): The collisional evolution of asteroids and their connections with meteorites - Radar imaging and shape-modeling of asteroids - Hydrocode simulation of collisions - Numerical modeling of meteorite delivery processes.

Radio Astronomy

Daniel Altschuler (Director, Arecibo Observatory; Senior Research Associate): Flux-density variability of continuum extragalactic radio sources and VLBI mapping of their structures - Mapping the galaxy distribution behind the anticenter region of the galactic plane - Fund-raising, the construction of the buildings, and the exhibition program for the Arecibo Visitor and Educational Facility (AOVEF).

Willem Baan (Spectrum Manager, Senior Research Associate): Molecular-line astronomy at radio and mm wavelengths - Molecular line research in active galactic nuclei - Galactic masers and extragalactic megamasers - Optical studies of active galactic nuclei - Studies of molecular and atomic emissions at high redshifts - Spectrum management in Puerto Rico and in the USA - Chairman of IUCAF, the spectrum management committee of the IAU, URSI, and COSPAR - Member of Working Party 7D in the USA and at the ITU.

Michael Davis (Upgrading Project Scientist, Senior Research Associate): Commissioning of the upgraded Gregorian system - Future improvements to the alignment of the 1000-ft reflector - High redshift HI, both emission and absorption - Adviser to SETI observing programs - Spectrum management, as chairman of CORF - Radio science, as chairman of URSI US Commission J - Future large aperture instruments.

Jo Ann Eder (Research Associate): The properties of gas-rich S0 galaxies and their implications for galaxy formation and evolution - The identification of "new" polar-ring S0 galaxies and the determination of their neutral gas content - The properties of dwarf irregular galaxies and the large-scale distribution of dwarf galaxies as a test for various theories of galaxy formation - The atomic gas content of active galaxies, star-forming galaxies, and ultra-luminous IRAS galaxies to investigate the relation between gas content and intense star-forming activity - A blind search for millisecond pulsars - REU summer student program - Development of the exhibits for the new AOVEF.

Tapasi Ghosh (Research Associate): Low-frequency variability of compact extragalactic radio sources - High-resolution studies of Seyfert Galaxies - Neutral-hydrogen contents of ultraluminous IR galaxies - Physical nature and spatial distribution of the ionized component of the interstellar matter.

Brian Murray Lewis (Senior Research Associate): Radio-frequency spectroscopy - Neutral hydrogen in galaxies - Masers in the circumstellar shells of red giant stars in their mass-loss phase, the late stages of stellar evolution - Precision of measurements, particularly with respect to radial velocities deriving from radio-frequency spectra.

Luca Olmi (Research Associate): The troposphere in limiting the performance of millimeter and sub-millimeter radio interferometers - Multi-transition studies of several molecular species in "hot-cores" associated with ultra-compact HII regions - Study of low-luminosity pre-main-sequence candidates in the molecular cloud Chamaeleon II - Software development to make the Arecibo line data compatible for analysis with CLASS and to point using conical-scan techniques.

Carmen Pantoja (Very recently graduated student): Galaxy distribution in the Zone of Avoidance.

Chris Salter (Head of Radio Astronomy Group, Senior Research Associate): Continuum emission from the galactic center at 84 GHz - The high-frequency spectra and polarization properties of compact-steep spectrum sources - HI-absorption of the radiation from pulsars - The continuum emission from supernova remnants - Clustering of radio galaxies seen through the galactic plane.

Kiriaki Xilouris (Research Associate): Millimeter-wavelength pulsar observations - High-frequency polarimetric pulsar studies - Millisecond pulsar polarimetry - Interaction of aged planetary nebulae with the ISM - Wide-field narrow-band photometry of extended low surface brightness SNRs.

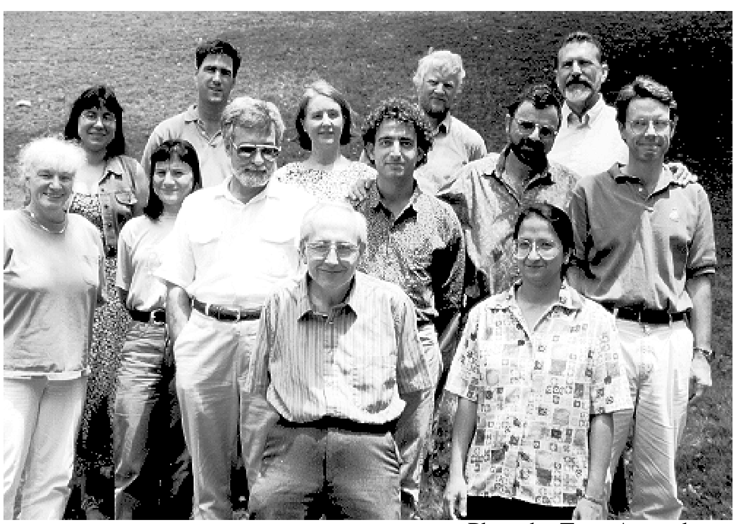

Photo by Tony Acevedo.

From left to right: Jo Ann Eder, Carmen Pantoja, Kiriaki Xilouris, Paul Castleberg, Murray Lewis, Alice Hine, Chris Salter, Luca Olmi, Willem Baan, Daniel Altschuler, Tapasi Ghosh, Mike Davis, John Harmon.

Summer Students, 1995

Jo Ann Eder

A new group of summer students have begun to arrive at the observatory. Each student will spend 10 weeks working on a research project with a scientific advisor and learning about the radio astronomy, radar astronomy, and atmospheric science being investigated at Arecibo.

The staff is happy to welcome: Marcel Agueros (Columbia), Jose Bartolomei Diaz (Univ. of Puerto Rico-Rio Piedras), Ann Bragg (Rice), Genene Fisher (Boston Univ.), Eran Jones (Southwest Missouri St. Univ.), Antonio Juarbe (Univ. of Puerto Rico, Mayagüez), Nicole Lloyd (Cornell), Kristin Nelson (Cornell), Henry Roe (Williams College), and Yu-Ling Su (National Central Univ., Taiwan).

The students will again be able to live on site in the VSQs. As in previous years, excursions will be organized to explore the island of Puerto Rico. We hope that the students will enjoy a productive and rewarding summer.

Status of the Visitor and Educational Facility

Daniel R. Altschuler

Of twelve pre-qualified contractors, four responded to Cornell's request for proposals. However, the lowest bid was still somewhat higher than the available funds, so we faced the choice of modifying the architectural design of the build-