

Large-Scale Pulsar Surveys with a Multibeam Feed Array System at Arecibo

James M. Cordes
Cornell University

A new multibeam feed array is being constructed for use on the Arecibo telescope, the Arecibo L-band Feed Array (ALFA). ALFA consists of seven feed horns and dual-polarization receiver systems providing 300 MHz bandwidth from 1225 to 1525 MHz. The beam width of each feed is approximately 3.6 arcmin. ALFA will become available approximately at the end of 2004 and is expected to be used in part for large-scale surveys of neutral hydrogen (Galactic and extragalactic), recombination lines, continuum surveys, rotating neutron stars (pulsars), and extraterrestrial intelligence. I will discuss ALFA pulsar surveys that will include:

1. A deep Galactic plane survey covering Galactic latitudes $|b| \lesssim 5^\circ$ and galactic longitudes accessible to Arecibo. Tentative specifications are a dwell time of 300 sec, 1024 channels across the 300 MHz bandwidth, and a dump time of 64 μ s. The total survey time is ~ 2000 hr and will take at least three years to finish. With these specifications, the ALFA survey will reach a maximum distance (at fixed luminosity) twice as far as that for the very successful Parkes multibeam survey that has discovered more than 600 new pulsars. The ALFA Galactic-plane survey will probe to the edge of the pulsar distribution. Its yield will include rare objects (e.g. relativistic binaries) that serve as laboratories for basic physics and a large pulsar sample that allows tomographic mapping of the Galaxy's spiral arms, ionized gas and magnetic field.
2. An out-of-plane survey optimized for detecting millisecond pulsars, relativistic binary pulsars with neutron-star and black-hole companions, and high-space-velocity pulsars. A shorter dwell time will allow coverage of a larger total solid angle than in the Galactic plane survey.
3. A shallow, all-Arecibo sky search for bright pulsars and transient sources.

It is expected that many of the ALFA surveys will be conducted in commensal (i.e. "piggy-back") mode where, for example, the Galactic plane pulsar survey takes place simultaneously with three other programs: a search for neutral hydrogen from galaxies in the zone of avoidance, mapping of Galactic hydrogen, and SETI.

Data management of ALFA pulsar surveys presents a formidable challenge because roughly 1 Petabyte of raw data are expected. The planning process for pulsar surveys includes consideration of management of both the raw data and data products, with timely delivery to the astrophysical community.

Further details on ALFA and science consortia may be found at <http://alfa.naic.edu/> and <http://www.astro.cornell.edu/~cordes/ALFA>.