Detection of Radio Pulsars and Transients in the Arecibo Pulsar-ALFA Survey

Julia S. Deneva*[1] and the PALFA Collaboration[2]

[1] Astronomy Department, Cornell University, Ithaca, NY 14853
[2] http://www2.naic.edu/alfa/pulsar

The ongoing Pulsar-ALFA (PALFA) survey utilizes the Arecibo telescope and a 7-beam receiver at 1.4GHz to search for radio pulsars and transients in the Galactic plane. Detectable radio transients may be produced by diverse and exotic phenomena. Young pulsars sporadically emitting giant pulses like the Crab pulsar would be detectable at intergalactic distances solely as transient sources. Debris from a disk around a neutron star which enter the light cylinder may give rise to irregularities in the pulsed radio emission like nulls, mode changes, and the sporadic bursts characteristic of Rotating Radio Transients (McLaughlin et al., Nature, 2006, 439, 817). In addition, energetic events like supernova explosions, neutron star binary mergers, and annihilating black holes are expected to have detectable radio signatures.

The single pulse search methods employed by the PALFA data processing pipeline routinely detect pulses from normal pulsars otherwise detectable as periodic emitters, and are essential in searching for and investigating the nature of intermittent emitters. We discuss the matched filtering and friends-of-friends search algorithms automatically applied to all data collected by the PALFA survey, as well as approaches like dynamic spectrum stacking used selectively in the follow-up of intriguing transient signals. To date, PALFA has discovered 35 new pulsars and 2 of the objects, J0628+09 and J1928+15, were discovered only based on single pulse detection.

The PALFA survey is going to accumulate ∼1PB of raw data which will be made available to the community via a tape archive hosted at the Cornell Center for Advanced Computing. Data processing products from pipelines at Cornell and other participating institutions are stored in an SQL database which is expected to reach ∼20TB by the time the survey is completed. Web tools and services are currently developed which will allow users to perform data analysis remotely.