Clocking Stars with Radio Telescopes
Timing Four Pulsars from the GBNCC Survey


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153.06 — Finding Compact Sources in the VLA Sky Survey

Cameron Riley1; Shami Chatterjee1; James Cordes1

1 Cornell University (Ithaca, New York, United States)

The VLA Sky Survey (VLASS) is a three epoch radio wavelength survey which covers over 33,000 deg2 of the sky as visible from the Very Large Array in New Mexico, USA. At a resolution of 2.5 arc-seconds and 120 microJansky RMS sensitivity per epoch, the VLASS is expected to locate around five million sources. We have initiated a project to identify candidate radio pulsars from the VLASS images for targeted follow up observations. To do so, we require a compact source catalog with minimal false positive detections that simultaneously does not miss out on real sources. We are testing the performance of various source finding tools to optimize such a catalog. In particular, Aegean Source Finder and PyBDSF were used to create catalogs for sample VLASS Quicklook images, which were analyzed for accuracy and completeness. Although more testing is required, our preliminary analysis shows that PyBDSF has a lower false positive detection rate and excels in differentiating sources within clusters, while Aegean has better performance in locating point sources. After further testing of other tools, we will construct a compact source catalog and use multiwavelength matches to rank pulsar candidates for follow up.

153.07 — Clocking Stars with Radio Telescopes: Timing Four Pulsars from the GBNCC Survey

Robert Aloisi1; Aristeo Cruz1; Luke Daniels1; Natalie Meyers1; Ryan Roedel1; Abigail Schuett1; Joe Swiggum1; Megan E. DeCesar1; Timothy Kaplan1; Ryan S. Lynch1,4; Kevin Stovall4; Lina S. Levin2; Anne Archibald5; Shawn Banaszak1; Pragya Chawla10; Bingyi Cui3; Emmanuel Fonseca10; Victoria Kaspi10; Vlad Kundratice6; Maura McLaughlin7; Hind Al Noori11; Scott M. Ransom9; Renee Spiewak1; Ingrid Stairs8; Joeri van Leeuwen3; Jason Boyles7; Jason Hessels9; Mallory Roberts11; Chen Karako-Argaman10; Xavier Siemens1

1 Center for Gravitation, Cosmology, and Astrophysics, Department of Physics, University of Wisconsin - Milwaukee (Milwaukee, Wisconsin, United States)
2 Department of Physics, McGill Space Institute for Radio Astronomy (Dwingeloo, Netherlands)
3 Department of Physics and Astronomy, West Virginia University (Morgantown, West Virginia, United States)
4 Department of Physics, University of Michigan (Ann Arbor, Michigan, United States)
5 Jodrell Bank Centre for Astrophysics, School of Physics and Astronomy, The University of Manchester, (Manchester, United Kingdom)
6 U. Amsterdam, the Netherlands Institute for Radio Astronomy (Dwingeloo, Netherlands)
7 Department of Physics and Astronomy, West Virginia University (Morgantown, West Virginia, United States)
8 Department of Physics and Astronomy, University of British Columbia (Vancouver, British Columbia, Canada)
9 Anton Pannekoek Institute for Astronomy, University of Amsterdam (Amsterdam, Netherlands)
10 Department of Physics, Brooklyn College (CUNY), New York, United States
11 New York University (Abu Dhabi, United Arab Emirates)
12 Department of Physics and Astronomy, Western Kentucky University (Bowling Green, Kentucky, United States)

We present the timing solutions for four pulsars discovered in the Green Bank Northern Celestial Cap (GBNCC) survey. Timing observations were processed and timing solutions were obtained by undergraduate students participating in course-based research at the University of Wisconsin - Milwaukee. Both discovery and timing observations were conducted at a center frequency of 350 MHz using the 100-m Robert C. Byrd Green Bank Telescope. All four pulsars are isolated with spin periods between 0.26 s and 1.84 s. PSR J0038-2501 has a 0.26 s period and a period derivative of 7.6 × 10−19 s−1, which is unusually low for isolated, longer period pulsars. This low period derivative may be simply an extreme value for an isolated pulsar or it could indicate an unusual evolution path for PSR J0038-2501, such as a disrupted recycled pulsar (DRP) from a binary system or an orphaned central compact object (CCO). Correcting the observed spin-down rate for the Shklovskii effect suggests that this pulsar may have an unusually low space velocity, which is consistent with expectations for DRPs since they come from disrupted binaries. There is no X-ray emission detected from PSR J0038-2501 in an archival Neil Gehrels Swift Observatory observation, which suggests that it is not a young orphaned CCO. A second pulsar, PSR J1949+3426 has a high dispersion measure suggesting that it is one of the most distant pulsars discovered in the GBNCC survey at an estimated distance of 12.3 kpc. Among the pulsars discovered in the GBNCC survey that makes it one of the brightest pulsars discovered in the GBNCC survey with a pseudo-luminosity of 570 mJy kpc2.