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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

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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 arcseconds 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

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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 $7.6 \times 10^{-19} \text{ s s}^{-1}$, 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 Shklovkii 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 pseudoluminosity of 570 mJy kpc².