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Two new relativistic MSPs from the HTRU-North

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We report on the two new MSP discoveries from the High Time Resolution Universe survey for pulsars and fast transients in the northern hemisphere (HTRU-North), being conducted with the 100-m Effelsberg telescope (Barr et al, 2013). The survey has so far resulted in the total number of 17 new pulsars. Here we present timing solutions for PSR J2045+3633 and PSR J2053+4650, both binary systems with massive companions ($>0.8 M_{\odot}$). Our objective is a precise mass measurement of the components of these binary systems.

PSR J2045+3633 has a spin period of 31.68 ms, orbital period of 32.3 days and orbital eccentricity $e = 0.017$. Such eccentricity, high for pulsar-white dwarf systems and low for double neutron star systems, indicates that this pulsar probably accreted very little matter from the massive, short-lived progenitor of its companion whose nature is not totally clear yet. Systems with eccentricities in this range are rare so are important for understanding the mildly-recycled pulsar population. Measuring their masses, we improve the sample of NS masses “at birth”. After one year of timing with the Effelsberg, Jodrell Bank, Arecibo and Nançay telescopes the derived pulsar mass estimate is $1.64 \pm 0.27 M_{\odot}$. The precision continues to improve quickly.

PSR J2053+4650 has a spin period of 12.58 ms and a highly-inclined (84.5°) circular 2.45-day orbit with a white dwarf companion. This high orbital inclination contributed to the detection of the Shapiro delay in the first timing campaign with the Effelsberg telescope, which, in turn, combined with the Jodrell Bank and Nançay observations, allowed us to measure the pulsar mass up to 16% precision: $1.52 \pm 0.25 M_{\odot}$.

Both pulsars are very bright (timing residuals of order $2 \mu s$ for 30-minute observations are obtained with Effelsberg) and promise to be a valuable addition to the pulsar timing arrays.

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