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New constraints on physics of NSs from parallaxes and proper motions

Using the most precise interferometric measurements of parallax and proper motion together with the rigorous statistical methods, we refined the natal kick velocity distribution for the neutron stars. The proper modelling of the natal kicks is essential to understand the formation of X-ray binaries, millisecond radio pulsars and double neutron stars (gravitational wave sources). We have found that the velocity distribution is bimodal: 42% of NSs receives the natal kicks with the standard deviation of 75 km/s and 58% with the standard deviation of 316 km/s. Using this natal kick distribution, we derived the Bayesian posteriors for kinematic ages for a large sample of young neutrons stars and found that the long-term magnetic field decay cannot occur on timescales shorter than 8 Myr, and it seems to happen on timescales of 12 Myr or longer.

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