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# Pulsar observations and constraints on the equation of state of nuclear matter in neutron stars

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Compact stars such as neutron star interiors are ideal laboratories for studying nuclear matter at extremely high densities. Pulsars are highly-magnetized, fast-rotating neutron stars that emit beams of electromagnetic radiation (ranging from radio to gamma rays) which we observe as periodic "pulses" with extraordinary regularity. Pulsar timing consists in the regular monitoring of the times-of-arrival of these pulses, and allows us to determine many pulsar properties with high precision, including orbital properties of pulsars in binary systems. In particular, radio observations of pulsars have led to precise measurements of neutron star masses, while X-ray observations of pulsars have helped determine neutron star radii. Since each proposed equation of state (EOS) of superdense nuclear matter in neutron stars leads to a unique neutron star mass-to-radius relation, the EOS can be constrained by neutron star mass and radius measurements from pulsar observations. We give an introduction to pulsar timing, constraints on the EOS of neutron stars and on theories of gravity. We also give an introduction on the planned Square Kilometre Array, which will allow us to improve the constraint on the EOS of neutron stars by one order of magnitude.

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