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Neutron Star Science with the Square Kilometre Array

In this talk I will give an overview of the Square Kilometre Array (SKA) and describe what it will do for neutron star science. The SKA is a project to build the largest radio telescope in the world and is currently in the final stages of its design. When constructed and operational it will focus on several scientific priorities, and chief amongst these is the study of neutron stars. The pulsar search system has been designed to be particularly capable at finding pulsars in binary systems. The SKA will be able to detect all radio pulsars in the Milky Way that are beamed towards Earth, perhaps numbering as many as 40 thousand. In the SKA's smaller initial deployment the expected yield is approximately 10 thousand, ~4 times the currently known population. The resultant population will then be studied using pulsar timing techniques to determine (i) many more precise mass measurements; (ii) moment of inertia measurements in short orbital period binaries; (iii) ever more neutron stars spinning at rates >500 Hz; (iv) the properties of glitches. Together these provide vital information on the neutron star equation of state, the physics of ultra-high density environments impossible to create in an Earth-bound laboratory, high density superfluidity, the physics of supernovae, and much more besides.

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