The Square Kilometre Array (SKA) is a global enterprise to build the largest scientific instrument on Earth, both in physical scale and in terms of the volume of data it will generate. Consisting of two telescope arrays located respectively in Australia and South Africa and managed from the SKA Organisation headquarters in the UK, the SKA promises to revolutionise our understanding of the universe. The science case for the SKA has the potential to appeal to users well beyond the radio astronomy community, spanning across a wide range of areas of physics, cosmology and astrophysics. Science working groups (SWGs) and Focus Groups (FGs) covering all these areas have been set up to further evolve the SKA science case, providing a conduit for interaction between the SKA Organisation science team and the astronomical community. This banner provides a summary of the Pulsars Science Working Group.

**Strong-field Tests of Gravity**

The SKA will discover new pulsars in highly relativistic binary systems that will yield unprecedented tests of gravity in the strong field regime, including tests of fundamental principles such as the strong equivalence principle, the existence of gravitational dipole radiation or extra field components. The discoveries will likely include at least one pulsar in orbit around a black hole, providing the ultimate laboratory for exploring and studying the physics of black holes, their space-time metrics and the no-hair theorem. Such observations may also provide critical pointers toward a quantum theory of gravitation.

**Dense Matter Equation of State**

Neutron stars provide unique laboratories to study the physics of matter at densities greater than that of atomic nuclei. The SKA will yield an order of magnitude increase in the number of neutron star mass determinations and high-energy observations can determine their radii. Valuable independent estimates of radii will also be determined by measuring moments of inertia of the most relativistic binary systems. Such constraints on the radii and rotational velocity will improve our understanding of neutron superfluidity by enabling detailed study of rotational irregularities in a wide range of pulsars.

**Gravitational Waves**

By regularly observing an array of millisecond pulsars, the SKA will be transformed into an unique observatory for low-frequency (nanohertz) gravitational waves, such as the stochastic background generated by the cosmic merger history of supermassive black hole binary systems. Depending on the strength of the stochastic background, the SKA may be able to characterize the shape of the strain spectrum and tell us about how supermassive black holes merge and galaxies evolve. The SKA may also enable studies of cosmic structure imprinted on anisotropies in the background and unique tests of gravitational theories in the radiative regime by investigating the polarization states of gravitational waves.

**Designed for Pulsar Astrophysics**

To address all of the above questions requires significant increases in both the number of discovered pulsars and the precision with which they are studied. Therefore, the SKA has been designed to undertake an ambitious pulsar survey of unprecedented scale and to regularly observe an array of pulsars with unsurpassed fidelity. By exploiting the latest advances in multi-processor technology, the SKA will achieve the enormous computational task of searching for highly relativistic pulsars over a large volume of the Galaxy in real-time. The remaining technical challenges revolve around semi-autonomous operation of the survey, including schedule optimisation, differentiating the pulsar needle from the overwhelming radio frequency interference haystack, and optimally searching orbital parameter space to produce phase-connected timing solutions for confirmed binary pulsar discoveries.