Cosmology with the Square Kilometer Array

The Square Kilometre Array (SKA) will be the largest radio observatory in the world with 3000 radio telescopes distributed in South Africa and Australia, and an effective area of $1\text{km}^2$. It is sometimes referred to as one of the most complex scientific instruments ever built. The SKA will create the largest map of the Large Scale Structure of the Universe, containing a wealth of information about the origin, composition, the physics and the evolution of the Universe. In particular, the SKA is expected to shed light on the nature of Dark Energy, measuring accurately its equation of state and being able to constrain/detect deviations from General Relativity. The SKA will also set tight measurements in the initial conditions of the Universe seeded by inflation by constraining primordial non-Gaussianities and the shape of the primordial power spectrum. Its precursor, MeerKAT, is already taking data and the scientific community need to get prepared for the data coming soon.

The student will work with simulated neutral hydrogen as observed by SKA based on the UNIT simulation. We will study how cosmological probes are affected by observational effects such as the telescope beam and foreground removal techniques. The student will develop techniques to analyse the SKA data in order to measure Baryonic Acoustic Oscillation as a standard ruler, Redshift Space Distortions as a probe of gravity together with the Alcock-Paczynski effect as a probe of cosmology.