Extragalactic Continuum
Science Working Group

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 extend well beyond the radio astronomy community, welcoming 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 mature the SKA science cases, providing a crucial link between the SKA science team and the astronomical community. This banner provides a summary of the Extragalactic Continuum Science Working Group. Continuous surveys with the SKA will explore the Universe from the nearest star-forming galaxies to high-redshift clusters of galaxies, examining structure formation and evolution on all scales. Our five focus areas are:

- **Star Formation History**
- **Active Galactic Nuclei**
- **Galaxy Clusters**
- **Strong Gravitational Lensing**
- **Detailed Astrophysics of Local Galaxies**

**Star Formation History**
Understanding when, where and how stars formed is a key question in astrophysics. Traditionally deep optical surveys are used to measure the star formation rates (SFR) at different epochs, but dust can obscure this emission. Unaffected by this, radio luminous (emissions from hydrogen gas) is a direct star formation tracer. Since HI is a critical coolant for star formation, it is a key tracer where it can be detected. Sensitivity surveys (at 2-3 GHz) will be used to map the bulk of the AGN population over a wide range of redshifts, environments and luminosities. At the same time SKA1 surveys will be sensitive to the oldest and earliest evolution of the Universe down to the primeval universe, all the way into the epoch of formation of the earliest LBGs (z > 7).

**Active Galactic Nuclei**
AGN feedback processes have become a standard ingredient in models of galaxy evolution, but a clear understanding of these complex processes and their true role in shaping galaxy evolution remains elusive. What is the relative importance of radioactive and photoionization feedback as a function of galaxy mass and epoch? Which role is played by the environment? Which drives these processes?

**Galaxy Clusters**
Galaxy clusters are the most massive objects in the Universe that have had the time to collapse under the influence of their own gravity. More than 90% of the huge cluster masses reside in dark matter. A hot and diffuse gas, permeating the space between cluster galaxies, dominates the baryonic component. Massive clusters can also act as giant radio loud sources. Radio continuum observations of clusters are vital for understanding the interplay between star-formation and gas evolution to both the compact constituents of the galaxies and the cosmic web filaments.

**Strong Gravitational Lensing**
Gravitational lensing produces multiple images of distant radio sources, allowing the mass distribution of the foreground gravitational lensing galaxy to be modelled, whilst providing a high magnification view of the high redshift Universe. The SKA2 Array will have an angular resolution of 0.35 arcsec, which is deep enough for detecting the gravitational lensing by galaxy-scale dark matter haloes. Shown is a simulation (left and middle) of a strongly lensed extended star-forming galaxy and a point-like AGN with a total flux-density of 1 mJy, when observed with SKA-MID (McKean et al. 2015). The sensitivity and wide field-of-view of SKA-MID will discover over 10^5 new gravitational lensing galaxies, allowing the mass distribution of the lensing galaxy to be modelled, whilst providing a high magnification view of the high redshift Universe. 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