Contribution ID: **61** Type: **not specified**

A renewed look at the impact of jetted AGN in the SKA era

Wednesday 6 October 2021 10:30 (20 minutes)

In recent years the unprecedented sensitivities provided by SKA precursors/pathfinders have started revolutionising our view even of previously well-known objects such as jetted AGN. In particular, observations in the MHz-frequency regime are able to unveil the oldest plasma injected by AGN jets in their surrounding medium, providing new insights into the jet duty-cycle and feedback, as well as into their interaction with the external medium over very long timescales. Here, I will present some spectacular systems, where we have detected old AGN plasma with complex filamentary morphology, which is interacting with the surrounding gas. These are clearly showing how the particles injected by AGN jets into their environment can get transported and distributed across the entire host system.
In particular, I will focus on a unique galaxy group called Nest200047, which we have investigated using LOFAR observations at 53 and 144 MHz combined with eROSITA data in the 0.5-2 keV-band. Here we have detected the late evolution of multiple generations of cosmic-ray AGN bubbles with an extraordinary level of detail. These have first transformed into toroidal ('mushroom-shaped') structures and are now in the process of getting shredded into a multitude of filamentary substructures. Interestingly, despite a long and apparently rather complicated evolution, even the oldest radio plasma is not yet thoroughly mixed with the thermal plasma after hundreds of million years, likely under the action of magnetic fields. However, this lack of mixing by no means seems to reduce the efficiency of the AGN feedback, suggesting that the energy exchange between the bubbles and the surrounding medium happens without a thermal coupling between the two phases.
Overall, all these systems clearly anticipate the major role SKA will play in the advancement of our understanding on the impact of AGN jets on their surrounding environment.

Reasearch area

Extragalactic Continuum (galaxies/AGN, galaxy clusters)

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Session Classification: Non-Thermal Processes in Galaxy Clusters