



Contribution ID: 72

Type: **not specified**

Seeing the forest and the trees : a radio investigation of the ULIRG Mrk 273

Monday 30 May 2022 17:05 (15 minutes)

Galaxy mergers have been observed to trigger nuclear activity by feeding gas to the central supermassive black hole. One such class of objects are Ultra Luminous InfraRed Galaxies (ULIRGs), which are mostly late stage major mergers of gas-rich galaxies. Recently, large scale (~ 100 kpc) radio continuum emission has been detected in a handful of ULIRGs, all of which also harbour powerful AGNs. This hints at the presence of large scale radio emission being evidence for nuclear activity. Exploring the origin of this radio emission and its link to nuclear activity requires high sensitivity multi-frequency data. We present such an analysis of the ULIRG Mrk 273. Using the International LOFAR telescope (ILT), we detect spectacular large scale arcs in this system. This detection includes for the first time, a giant ~ 190 kpc arc in the north. We propose these arcs are fuelled by a low power radio AGN triggered by the merger. We also identify a bright ~ 45 kpc radio ridge, which is likely related to the ionised gas nebula in that region. We combine this with high sensitivity data from APERTure Tile In Focus (Apertif) and archival data from the Very Large Array (VLA) to explore the spectral properties. The ILT simultaneously allows us to probe the nucleus at a resolution of $\sim 0.3''$, where we detect three components, and, for the first time, diffuse emission around these components. Combining this with archival high frequency VLA images of the nucleus allows us to detect absorption in one component, and a steep spectrum radio AGN in another. We then extrapolate from this case study to the importance of investigating the presence of radio emission in more ULIRGs and what it can tell us about the link between mergers and the presence of radio activity.

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Session Classification: Parallel Session: Galaxies & Cosmology