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The Role of the EVN in our Understanding of High-redshift Star-formation Activity and Low-Luminosity AGN Systems through Integrated Imaging across Wide Spatial Scales

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The development of deep high-resolution radio imaging has allowed astronomers to separate and characterise the AGN and star-formation activity in both the local and distant Universe, allowing obscuration-free derivation of the star-formation rate density evolution over cosmic time. Crucially, the high sensitivity of the EVN, with many additional telescopes worldwide and increased correlation bandwidths can now be used to image faint AGN activity within star-forming galaxies (SFG) and thus investigate AGN feedback in such systems. In addition, integrated imaging including both VLA and e-MERLIN short and intermediate spacing data, is allowing seamless detailed imaging on angular scales from arcseconds to mas on the evolving populations of SFGs and AGN systems to μJy sensitivity.

With the upcoming e-MERGE GOODS-N survey DR-1 initial data and image releases, the EVN together with e-Merlin and the VLA can be used to investigate the faint embedded AGN-jet systems and their interactions in both nearby star-forming galaxies and those far more luminous systems at high redshift, many of which contain nuclear starbursts only partially resolved by e-MERLIN. In particular deep high angular resolution imaging of star-forming systems in GOODS-N are used to characterise both the SFG population, together with the heterogeneous nature of the 'Radio-Quiet' AGN systems which dominate the AGN radio population at faint flux density levels below S1.4GHz~100μJy; and the evolving nature of the remaining 'Radio-Loud' sources at μJy flux density levels where the small core-dominated radio structures are found to be confined to within the host galaxy and contain almost equal numbers of one- and two-sided extended structures. This new class of 'Radio-Loud' AGNs may be the first detections (at the luminous end of the class) of the high-redshift equivalent to the local Universe low luminosity 'FR0' structures identified by (Baldi+16, Baldi+18) which are the most common form of radio-loud AGN systems seen locally.