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The Radiative Origins of Radio Emission in Galaxies

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The faint radio population contains a higher proportion of star-forming galaxies (SFGs) and radio-quiet or non-jetted active galactic nuclei (AGN) below radio flux densities of approximately 100 microJy. It is commonly understood that radio emission in SFGs is primarily thermal and for radio-loud AGN, it is mainly non-thermal. The radiative mechanisms producing radio emission in non-jetted AGN, however, are still up for debate. To investigate the production channels for radio emission at the faintest flux densities, we combine LOFAR 144 MHz, uGMRT early-science band-3 (390 MHz) and band-4 (650 MHz), and MIGHTEE DR1 flux detections to measure spectral indices and spectral curvature for radio-AGN and SFGs in XMM-LSS. We cross-identify our radio sources with multi-band data and find a distribution of galaxies peaking in number count at z=1 and detected up to z˜6. We use results from CIGALE spectral energy distribution-fitting to obtain the stellar mass and star-formation rate of the radio-detected galaxies and classify them into AGN and SFGs. Our early results show evidence for peaked radio spectra indicative of both spectral of both synchrotron (self-)absorption and emission in the radio-loud AGN. For SFGs, the steep and downturned spectral curvatures indicative of thermal radiation and synchrotron emission from the sources in the star-forming galaxies (which may also contain a subset of non-jetted AGN). This work is an important step towards determining the mechanisms powering radio emission in jet-dominated and star-forming-dominant galaxies.

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