The VLA Survey of the Chandra Deep Field South. V. Evolution and Luminosity Functions of sub-mJy radio sources and the issue of radio emission in radio-quiet AGN

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We present the evolutionary properties and luminosity functions of the radio sources belonging to the Chandra Deep Field South VLA survey, which reaches a flux density limit at 1.4 GHz of 43 microJy at the field center and redshift ~5, and which includes the first radio-selected complete sample of radio-quiet active galactic nuclei (AGN). We use a new, comprehensive classification scheme based on radio, far- and near-IR, optical, and X-ray data to disentangle star-forming galaxies from AGN and radio-quiet from radio-loud AGN. We confirm our previous result that star-forming galaxies become dominant only below 0.1 mJy. The sub-mJy radio sky turns out to be a complex mix of star-forming galaxies and radio-quiet AGN evolving at a similar, strong rate; non-evolving low-luminosity radio galaxies; and declining radio powerful (P > 3 10^24 W/Hz) AGN. Our results suggest that radio emission from radio-quiet AGN is closely related to star formation. The detection of compact, high brightness temperature cores in several nearby radio-quiet AGN can be explained by the co-existence of two components, one non-evolving and AGN-related and one evolving and star-formation-related. Radio-quiet AGN are an important class of sub-mJy sources, accounting for ~30% of the sample and ~60% of all AGN, and outnumbering radio-loud AGN at < 0.1 mJy. This implies that future, large area sub-mJy surveys, given the appropriate ancillary multi-wavelength data, have the potential of being able to assemble vast samples of radio-quiet AGN by-passing the problems of obscuration, which plague the optical and soft X-ray bands.

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