The Radio and Optical Morphologies of Micro-Jansky Radio Sources

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Abstract

We have imaged a 17′-region in the SSA13 field with the VLA at 1.4 GHz with a resolution of 1.8″, and we have obtained sensitive Subaru images at R-band (0.9 μm) and Z-band (1.3 μm) with a seeing of 1.1″. The field center is at RA=13 23 17.4, DEC=42 38 05.0 and we have detected 548 radio sources in the complete sample with image flux density > 27.5 μJy. Over 95% are identified on the Z-band image, to a limiting magnitude of 25.8 mag. The major properties of the sources are: (1) Over 30% of the identifications are with Extremely Red Objects; (2) The average radio angular size is 1.35″ and very few sources are larger than 5″, except seven relatively bright extended AGN; (3) The differential count of radio sources has a slope of -2.3, and there is significant difference in the source density of this field compared with other fields; (4) The radio spectral index between 1.4 and 8.4 GHz steepens considerably below 100 μJy.

A detailed comparison of the hundreds of radio/optical associations show the following: (1) About 50% of the radio sources are identified with relatively isolated galaxies and 35% with binary systems. (2) The orientation of many radio sources are similar to the optical counterpart or the separation of the binary system if applicable, suggesting that the emission is primarily associated with the star formation process. (3) About 25% of the radio sources are smaller than 1″ and are AGN candidates. However, many of these are probably associated with compact starformation regions. (4) About 20% of the radio sources are considerably displaced from the central regions of the optical counterpart. Thus, a comparison of radio and optical morphologies contain information about the evolution and time-scale of starburst activity and the increases resolution and sensitivity from new instruments will permit modeling of the evolutions and dynamics of starburst and galaxy mergers.