Giants towards the Edge of the Universe: Mpc-scale radio galaxies at low and high redshift

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Abstract

Giant radio galaxies (GRGs) are those with a projected linear size LLS >1 Mpc/h_{75}, and only about 150 of them are reported in the literature. In recent efforts of our research team we have used automated algorithms as well as visual inspection of large-scale radio surveys like NVSS, WENSS, SUMSS and FIRST, to increase the number of known GRGs. These methods, together with findings of volunteers of the Radio Galaxy Zoo project, have led us to increase the number of known GRGs to over 500.

Here we restrict ourselves to the 193 GRGs with optical spectra of their hosts available in SDSS DR12, and classify these according to their activity type, namely QSOs, Sy1, Sy2, LINER, dwarf AGN, and those without emission lines. We find that GRGs are hosted by galaxies of all these types. We divide the sample in a low- and high-redshift one at their median redshift ($z \sim 0.4$), giving 91 low-z and 102 high-z GRGs. We find a clear difference between the two samples, suggesting a much higher level of activity at z >0.4: the fraction of QSO+Sy1 types is 40% at low z, and 80% at higher z. Likewise, the fraction of dwarf AGN is 30% at low z and only 10% at $z > 0.4$. Since there is no significant trend for the linear sizes of the sources to change with redshift, we conclude that the evolution in spectral activity occurs on a shorter time scale than that of the radio activity. This would be consistent with the view that GRGs grow so large because they have a longer period of radio activity compared to smaller sources, and that the radio activity depends more on the *efficiency* of accretion onto the central black hole rather than on the accretion *rate*.

We classify the radio morphology into Fanaroff-Riley classes FR I and FR II and find that FR I's occur almost exclusively at z <0.4. Contrary to the accepted paradigm, for these low-z GRGs we find no segregation in radio luminosity at all between FR I and II types.