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## The GRACE project: high-energy giant radio galaxies and their duty cycle

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The advent of new generation radio telescopes is opening new possibilities on the classification and study of extragalactic high-energy sources, specially the underrepresented ones like radio galaxies. Among these, Giant Radio Galaxies (GRG, larger than 0.7 Mpc) are among the most extreme manifestations of the accretion/ejection processes on supermassive black holes. Our recent studies have shown that GRG can be up to four times more abundant in hard X-ray selected (i.e. from INTEGRAL/IBIS and Swift/BAT at  $>20$  keV) samples and, most interestingly, the majority of them present signs of restarted radio activity. This makes them the ideal testbed to study the so far unknown duty cycle of jets in active galactic nuclei. Open questions in the field include: How and when jets are restarted? How jets evolve and what's their dynamic? What is the jet's duty cycle and what triggers them? Our group has recently collected a wealth of radio data on these high-energy selected GRGs, allowing us to study their jet formation and evolution from the pc to kpc scales, across different activity epochs. Furthermore, we are devoting an effort to the exploitation of new radio surveys data for the discovery of new classes of counterparts of Fermi/LAT and ANTARES catalogues. In particular, we are unveiling the hidden population of radio galaxies associated with gamma-ray sources, and possibly with neutrino events.

### Research area

Extragalactic Continuum (galaxies/AGN, galaxy clusters)

**Primary author:** Dr BRUNI, Gabriele (INAF - Istituto di Astrofisica e Planetologia Spaziali)

**Co-author:** Dr PANESSA, Francesca (Istituto Nazionale di Astrofisica (INAF))

**Presenter:** Dr BRUNI, Gabriele (INAF - Istituto di Astrofisica e Planetologia Spaziali)

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