ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

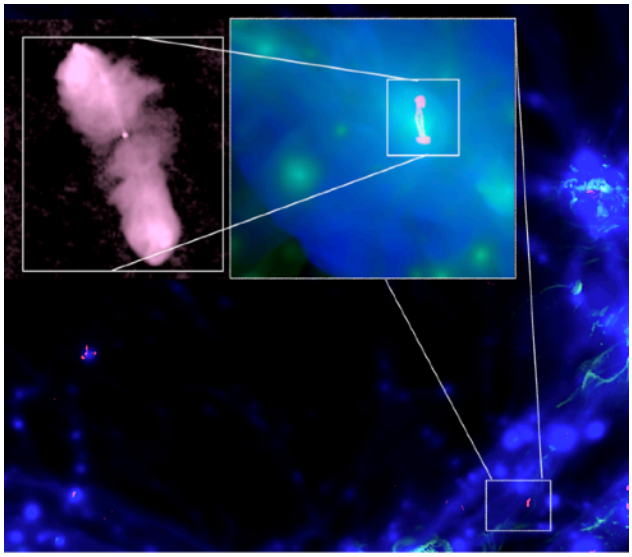
DIPARTIMENTO DI FISICA E ASTRONOMIA
Department of Physics and Astronomy - DIFA

PhD project in ASTROPHYSICS

Title of the Project:
Physics and observables of the thermal and non-thermal output of radio galaxies in large-scale structures
Proprietà fisiche ed osservative del feedback termico e non termico delle radio galassie nelle strutture cosmiche.

Supervisor : Prof. Franco Vazza
Co-Supervisors : Prof. Fabrizio Brighenti

Scientific Case:
Radio Galaxies are one of the most spectacular example of how astrophysics couples spatial and temporal scales separated by many orders of magnitude, and they also are a key ingredient of galaxy formation.
The long-term evolution of relativistic plasmas, injected by radiogalaxies over their evolution and mixing with the surrounding intracluster or intergalactic medium, depends on a complex sequence of loss and re-energisation events. Correctly estimating the energetics and timing of the feedback event associated with feedback events from active galactic nuclei, both in the X-ray or in the radio band, is currently limited by a number of systematic sources of uncertainties. Only through the careful design and analysis of realistic simulations of these complex phenomena it will be possible to overcome the existing uncertainties, which hampers the possibility of correctly assessing the underlying energetics and duty cycle of active galactic nuclei in large-scale structures.



Outline of the Project:
The PhD candidate will work at the design, testing and application of new numerical modules to produce realistic & fully cosmological simulations of the co-evolution of radiogalaxies in galaxy clusters and galaxy groups. The final product of the simulations will be carefully compared with available observables, both from X-ray and radio observational campaign, with the goal of understanding how to relate observed energetics and timing parameters of radio lobes and X-ray cavities, with the true physical parameters in the simulated model. The PhD candidate will be involved in all existing scientific activities and lines of research of the MAGCOW group (https://cosmosimfrazza.myfreesites.net/erc-magcow). He/she will have access to all numerical method and physical models developed by the group, which will be helpful to model the ageing and re-acceleration of fossil plasmas in complex objects, and connect the thermal and non-thermal evolution of there energy components.

Given its topic and workflow, this project calls for candidates with experience in numerics and/or theoretical modelling, or with a strong motivation to learn them.

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