INAF
ISTITUTO NAZIONALE
DI ASTROFISICA

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

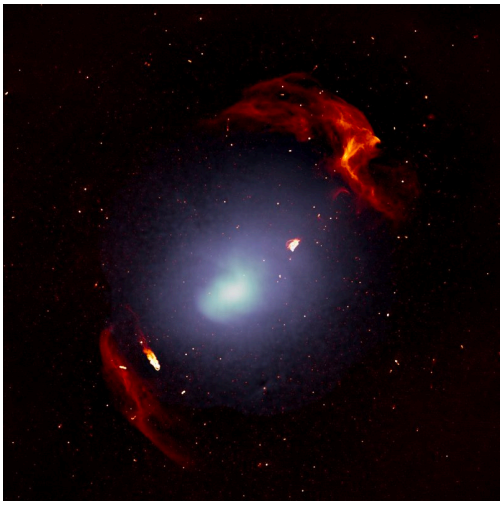
DIPARTIMENTO DI FISICA E ASTRONOMIA
Department of Physics and Astronomy - DIFA

erc
European Research Council

PhD project in ASTROPHYSICS

Title of the Project: From supermassive black holes to cosmic shocks with frontier radio telescopes
Supervisor : De Gasperin Francesco

Scientific Case:
During the process of cosmic structure formation matter accretes along the filaments of the cosmic web. Galaxy clusters form at the knots of the web. This process releases large quantities of gravitational energy. Part of this energy is channelled into shock waves that we study using X-ray and radio observations (see image), these structures are unique laboratories at the crossroad of observational astronomy, plasma physics and cosmology. Another important actor releasing large quantity of energy in the large scale structure are supermassive black holes in active galactic nuclei (AGN). Both cosmic shocks and AGN activity can now be studied with incredible detail at low-frequencies (using LOFAR) and at high frequencies (using MeerKAT and VLA). The combination of these observations enables an unprecedented insight into their internal structure including the presence of complex substructures and filaments. The understanding of these processes is key to complete the picture of the formation of the large scale structure of our Universe.



Double cosmic shock in Abell 3667 observed with MeerKAT

Outline of the Project:
The candidate will have privileged access to proprietary data from the MeerKAT (www.sarao.ac.za/science/meerkat/) and LOFAR (www.lofar.org) radio interferometers. The student will work on the observations preparation, execution, data analysis and interpretation of the results.
For the interpretation of the results, and depending on the candidate's attitude, the project can be tuned to leverage the observational (radio, X-ray) or theoretical (plasma physics and simulations) part.
The candidate will be part of the LOFAR collaboration that includes >200 scientists from several European countries and of the UltraLowUniverse research group that includes 4 PhDs and 5 postdocs financed by a European ERC Grant. This grants the possibility of creating a large international network through visits and conferences as well as the access to state-of-the-art computing facilities. The possibility of spending one year of PhD at the University of Hamburg (DE) can be discussed as well as earning a double PhD (UniBO and UniHamburg).

Collaborators: M. Bruggen (simulations) and G. Brunetti (theory)
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