

Collaborative research on VLBI as an ultimate test to Λ CDM model

PI: C. Spingola (INAF-IRA)
Mini-Grant RSN4

This mini-grant is funding high-impact VLBI research with visits to collaborators in Europe and the USA. The project includes VLBI observations with the three INAF antennas (Sardinia Radio Telescope, Medicina and Noto).

The research is divided in three main goals (A, B, C), which aim at testing the Λ CDM model at galactic/sub-galactic scales on different aspects. A separate goal (D) is related to the INAF-VLBI array used as a stand-alone interferometer.

We highlight in **orange** the tasks envisioned in the proposal that have not been completed yet. The rest has been completed.

Expected output: 3 first-author publications and **1 paper dedicated only to the INAF antennas.**

Talks at international conferences and colloquia at VLBI institutes were expected: given the arriving time of the funds, the Fermi Symposium could not be attended.

Total budget: 14 100 euro
Budget spent: 9 600 euro

A) Nature of dark matter with VLBI

Collaborators involved: D. Powell & S. Vegetti (MPA, Munich DE)

Invited Review Talk at EVN Symposium «Cosmological studies with VLBI» in Cork (IRL) July 2022

Invited colloquium at ASTRON/JIVE (Netherlands) entitled «Cosmological studies with strong lensing and VLBI» March 2023

Contributed talk at international conference «New eyes on the Universe: SKA and ngVLA» in Vancouver (CA) May 2023

Invited talk at international conference «Bologna-VLBI: Life begins at 40» in Bologna (ITA) May 2023

Visit to Dr. Powell: we worked together at the SHARP face-to-face meeting in Torino instead of MPA (June 2023)

Relative publications (3): Powell et al. 2022, Powell et al. 2023, Spingola 2023A

B) A possible binary SMBH excess at $z > 1$

Collaborators involved: D. Schwartz & A. Barnacka (CfA Harvard & Smithsonian, Boston, USA)

Relative publications (2): Spingola et al. 2022, Spingola 2023B (invited Nature «News and views»)

The results of this project were also presented in the invited review talk at EVN Symposium (2022) and at the invited talk at the Bologna-VLBI conference (2023)

The group obtained 425ks observations at Chandra X-ray telescope (PI: Schwartz, co-I: Spingola, Migliori, Barnacka)

We also won NASA ADAP 2023 fundings (337 000\$) for this science case

The visit to CfA is scheduled for 2024. During that visit I will also give a talk on this project.

Writing of a paper is on-going (Spingola et al. in prep)

C) Missing blazars in the early Universe

Collaborators involved: S. Belladitta (MPIA, Heidelberg DE)

Relative publications (2): Belladitta et al. 2023, Gloudemans et al. 2023

Data reduction of the VLBI and VLA datasets is on-going

Dr. Belladitta visit is expected in 2024

D) INAF-VLBI (MC + NT + SRT)

Collaborators involved: VLBI/High-energy group at INAF-IRA

Successful INAF-VLBI observations of a lens have been analysed

Contributed talk at AGN XIV Meeting «The renaissance of black holes and galaxies» in Firenze (ITA) May 2022

Contributed talk at «Bologna and Friends Workshop» at INAF-IRA in March 2023

Writing of the publication is on-going (Spingola et al. in prep)