Théo Lebeau

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Keywords: study of gas dynamics in and around galaxy clusters and their impact on the hydrostatic mass bias using cosmological simulations

Research Experiences

- **PhD** *Oct 2022 - present*
  Institut d'Astrophysique Spatiale (IAS) Orsay, France
  – Title: "Mass calibration from constrained simulations: towards bias-free scaling relations for galaxy clusters."
  – Supervisors: Nabila Aghanim & Jenny Sorce
  – Expected defence date : September 2025

- **2nd year Master Degree research intership** *Mar 2022 - Jun 2022*
  Institut d'Astrophysique Spatiale (IAS) Orsay, France
  – Project: Study of a constrained zoom-in simulation of the Virgo cluster
  – Supervisors: Nabila Aghanim & Jenny Sorce

- **1st year Master Degree research intership** *May 2021 - Jul 2021*
  Institut d'Astrophysique Spatiale (IAS) Orsay, France
  – Project: Study of galaxy clusters pressure profiles in the IllustrisTNG simulation
  – Supervisors: Nabila Aghanim & Hideki Tanimura

- **Bachelor research intership** *Jan 2020*
  Laboratoire de Physique SUBAtomique et TECHnologies associées (SUBATECH) Nantes, France
  – Project: Calibration of the XENON1T detector using ^{83m}Kr and light yield determination
  – Supervisors: Sara Diglio and Julien Masbou

Education

- **Magister degree in Fundamental Physics, specialisation in Astrophysics (M2)** *2022*
  Université Paris-Saclay Orsay, France

- **Bachelor degrees in Physics and Mathematics** *2020*
  Université de Nantes Nantes, France

Publications

Refereed (rank A)

1. *Turbulence from cosmic filaments to galaxy clusters*
   Lebeau, Zaroubi, Aghanim, Sorce & Langer, submitted to A&A, ArXiv ID: 2501.09573

2. *Can the splashback radius be an observable boundary of galaxy clusters?*
   Lebeau, Ettori, Aghanim & Sorce, A&A 689, A19 (2024)

3. *Simulating the LOcal Web (SLOW) – II: Properties of local galaxy clusters*
   Hernández-Martínez, Dolag, Seidel, Sorce, Aghanim, Pilipenko, Gottlöber, **Lebeau** & Valentini, A&A 687, A253 (2024)

4. *Mass bias in clusters of galaxies: Projection effects on the case study of Virgo replica*
   Lebeau, Sorce, Aghanim, Hernández-Martínez & Dolag, A&A 682, A157 (2024)

Proceedings

1. *Projection effects on pressure profiles: a case study of the Virgo replica*
   Lebeau, Sorce & Aghanim, mm Universe Proceedings, EPJ Web of conferences, 2024

2. *CLONES: digital twins of the local Universe*
   Sorce, Aghanim, **Lebeau** et al., High Performance Computing in Science and Engineering – Garching/Munich, 2024

Talks

Invited talks and seminars

1. **Physics processes of the cosmic gas in galaxy clusters environment** — *Oct 2024*
   Day of the astrophysics axis of the Univ. Paris-Saclay Graduate School — Orsay, France

2. **Physics processes biasing galaxy clusters mass estimation: case study of the Virgo cluster simulated replica** — *Sep 2024*
   INAF-OAS Seminar — Bologna, Italy

Contributed talks

1. **Turbulence from cosmic filaments to galaxy clusters** — *Nov 2024*
   SNO Ramses days — Paris, France

2. **Physics processes biasing galaxy clusters mass estimation: case study of the Virgo cluster simulated replica** — *Oct 2024*
   Ultimate cluster cosmology workshop — Orsay, France

3. **Turbulence in the ICM of the Virgo cluster simulated replica** — *Jul 2024*
   EAS annual meeting — Padova, Italy

4. **Can the splashback radius be an observable boundary of galaxy clusters ?** — *May 2024*
   GdR Cophy Episode 2 — Lyon, France

5. **Can the splashback radius be an observable boundary of galaxy clusters ?** — *May 2024*
   Tuorla-Tartu meeting — Turku, Finland

6. **Gas dynamics in the ICM of galaxy clusters: case study of a Virgo replica** — *Mar 2024*
   Elbereth Conference — Paris, France

7. **Mass bias in clusters of galaxies: case study of Virgo CLONE replica** — *Dec 2023*
   RAMSES SNO kick-off meeting — Lyon, France

8. **Biases in the estimation of the hydrostatic mass of the Virgo simulated CLONE** — *Jun 2023*
   mm Universe conference — Grenoble, France

9. **Biases in the estimation of the hydrostatic mass of the Virgo simulated CLONE** — *Jun 2023*
   CLUES meeting — Munich, Germany

10. **Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations** — *Mar 2023*
    Elbereth Conference — Paris, France

Posters

1. **Turbulence in galaxy clusters and cosmic filaments** — *Jun 2024*
   IAS young researchers and ingeeners day — Orsay, France

2. **Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations** — *Dec 2023*
   Colloque Alain Bouyssy — Orsay, France

3. **Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations** — *Oct 2023*
   Journée de l'axe Astro de la Graduate School de Physique de l'Université Paris-Saclay — Orsay, France

4. **Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations** — *Jun 2023*
   IAS young researchers and ingeeners day — Orsay, France

5. **Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations** — *Apr 2023*
   "Future Cosmology" summer school — Cargèse, France

Supervision and teaching

- **Co-Supervision of Jade Paste (1st year Master Degree trainee)** *May-Jun 2024*
  2 months research internship
- **Astronomy pratical works (15h/year)** *2022-present*
  1st year Master Degree
- **Electromagnetism courses (21h/year)** *2023-2024*
  2nd year Bachelor Degree
- **Co-supervision of astronomy projects (one week)** *2023*
  1 week project with four students of 3rd year Bachelor Degree

Main Skills

Programming Languages: Analysis of cosmological simulations with Fortran (own RAMSES-related data preparation and map creation codes) and Python (use of scientific (numpy,scipy,astropy,...), visualisation (matplotlib,pyvista,...) and optimisation (numba,jax,...) libraries)
Languages: English (fluent), French (mother tongue)

Contributions to the community

International

- **Referee for "The Open Journal of Astrophysics"** *2024*

Local

- **Member of the LOC for the Ultimate Cluster Cosmology workshop @ IAS** *2024*
- **Co-organisation of bimonthly Cosmology team seminars** *2024 - present*
- **Organisation of the IAS young researchers and engineers day** *2024*
- **Elected as doctoral student representative at the laboratory board** *2024 - present*
- **Elected as doctoral student representative at the Paris-Saclay University Physics Graduate School board** *2023 - present*
- **Management of the Cosmology team's conference webpage** *2022 - 2024*

Collaborations

- **Member of the LOCALIZATION project** *2022-2025*
  P.I.s: Nabila Aghanim (IAS,Paris-Saclay University) & Klaus Dolag (LMU, Munich)

Grants

- **Financial support from doctoral school to participate to "Future Cosmology" summer school (∼500€)** *Apr 2023*
- **3-years PhD half-grant from doctoral school "Astronomie & Astrophysique d'Ile-de-France" (∼50k€)** *2022 - 2025*

Proposals

- **Co.I of project Proposal for Tier 0/Tier 1 HPC Access at the Gauss Center for supercomputing** *2023*
  45Mcpu hours obtained on the LRZ supercomputer to run the LOCALIZATION simulation

Outreach

- **"The story of my PhD", ALCOR Astronomy association event** *Oct 2024*
- **Conference "Introduction to cosmology" for secondary school students** *Dec 2023*
- **Participation to the "Science Festival 2022" at IAS** *Oct 2022*

Personal Interests

- **Basketball in competition**
- **Guitar in amateur band**

References

- **Nabila Aghanim**: nabila.aghanim@universite-paris-saclay.fr
- **Jenny Sorce**: jenny.sorce@univ-lille.fr
- **Stefano Ettori**: stefano.ettori@inaf.it
- **Saleem Zaroubi**: saleem@astro.rug.nl