

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 - Oct 2025
Institut d'Astrophysique Spatiale (IAS) Orsay, France
 – Title: "The impact of physical processes in and around galaxy clusters on the estimation of their boundaries and mass: case study of the Virgo cluster numerical replica"
 – Supervisors: Nabila Aghanim & Jenny Sorce
 – Defence date: 2nd of October, 2025
- **2nd year Master Degree research internship** 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 internship** 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 internship** 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 & 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) as first author

1. *Gas motion in the ICM of the Virgo cluster replica*
Lebeau, Ettori, Aghanim, Sorce & Paste, Submitted to A&A, under revision, ArXiv ID: 2506.14441
2. *Velocity fields and turbulence from cosmic filaments to galaxy clusters*
Lebeau, Zaroubi, Aghanim, Sorce & Langer, re-submitted to A&A, under second revision, ArXiv ID: 2501.09573
3. *Can the splashback radius be an observable boundary of galaxy clusters?*
Lebeau, Ettori, Aghanim & Sorce, A&A 689, A19 (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)

Refereed (rank A) as co-author

1. *Simulating the Local Web (SLOW) – V: Thermodynamic Properties and Evolution of Local Galaxy Clusters*
 Hernández-Martínez, Dolag, Steinwandel, Sorce, **Lebeau**, Aghanim & Seidel,
 Submitted to A&A, under revision, ArXiv ID: 2507.15858
2. *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)

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. **Can the splashback radius be an observable boundary of galaxy clusters?**
Seminars of the CMB-S4 clusters analysis working group
Mar 2025
online (Univ. of Illinois, USA)
2. **Physics processes of the cosmic gas in galaxy clusters environment**
Day of the astrophysics axis of the Univ. Paris-Saclay Graduate School
Oct 2024
Orsay, France
3. **Physics processes biasing galaxy clusters mass estimation:
case study of the Virgo cluster simulated replica**
INAF-OAS Seminar
Sep 2024
Bologna, Italy

Contributed talks

1. **Gas motion in the ICM of the Virgo cluster replica**
EAS annual meeting
Jun 2025
Cork, Ireland
2. **Can the splashback radius be an observable boundary of galaxy clusters?**
Expanding the boundaries of dark matter halos workshop
May 2025
online (Shanghai, China)
3. **Turbulence from cosmic filaments to galaxy clusters**
SNO Ramses days
Nov 2024
Paris, France
4. **Physics processes biasing galaxy clusters mass estimation:
case study of the Virgo cluster simulated replica**
Ultimate cluster cosmology workshop
Oct 2024
Orsay, France
5. **Turbulence in the ICM of the Virgo cluster simulated replica**
EAS annual meeting
Jul 2024
Padova, Italy
6. **Can the splashback radius be an observable boundary of galaxy clusters ?**
GdR Cophy Episode 2
May 2024
Lyon, France
7. **Can the splashback radius be an observable boundary of galaxy clusters ?**
Tuorla-Tartu meeting
May 2024
Turku, Finland
8. **Gas dynamics in the ICM of galaxy clusters: case study of a Virgo replica**
Elbereth Conference
Mar 2024
Paris, France
9. **Mass bias in clusters of galaxies: case study of Virgo CLONE replica**
RAMSES SNO kick-off meeting
Dec 2023
Lyon, France
10. **Biases in the estimation of the hydrostatic mass of the Virgo simulated CLONE**
mm Universe conference
Jun 2023
Grenoble, France
11. **Biases in the estimation of the hydrostatic mass of the Virgo simulated CLONE**
CLUES meeting
Jun 2023
Munich, Germany
12. **Towards bias-free mass calibration of galaxy clusters using constrained
cosmological simulations**
Elbereth Conference
Mar 2023
Paris, France

POSTERS

1. **Gas motion in the ICM of the Virgo cluster replica**
Tracing Cosmic Evolution with Galaxy Clusters V Conference
Jul 2025
Sesto, Italy
2. **Studying physics processes in and around galaxy clusters
with cosmological simulations**
IAS young researchers and engineers day
May 2025
Orsay, France

- | | |
|---|------------------------------------|
| 3. Turbulence in galaxy clusters and cosmic filaments
<i>IAS young researchers and engineers day</i> | <i>Jun 2024</i>
Orsay, France |
| 4. Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations
<i>Colloque Alain Bouyssy</i> | <i>Dec 2023</i>
Orsay, France |
| 5. Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations
<i>Journée de l'axe Astro de la Graduate School de Physique de l'Université Paris-Saclay</i> | <i>Oct 2023</i>
Orsay, France |
| 6. Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations
<i>IAS young researchers and engineers day</i> | <i>Jun 2023</i>
Orsay, France |
| 7. Towards bias-free mass calibration of galaxy clusters using constrained cosmological simulations
<i>"Future Cosmology" summer school</i> | <i>Apr 2023</i>
Cargèse, France |

SUPERVISION AND TEACHING

- | | |
|---|---------------------|
| • Co-Supervision of Léa Gagneux (2nd year Bachelor Degree trainee)
<i>3.5 months research internship</i> | <i>Jan-Apr 2025</i> |
| • Co-Supervision of Jade Paste (1st year Master Degree trainee)
<i>2 months research internship</i> | <i>May-Jun 2024</i> |
| • Astronomy practical works (15h/year)
<i>1st year Master Degree</i> | <i>2022-2024</i> |
| • Electromagnetism courses (21h/year)
<i>2nd year Bachelor Degree</i> | <i>2023-2024</i> |
| • Co-supervision of astronomy projects (one week)
<i>1 week project with four students of 3rd year Bachelor Degree</i> | <i>2023</i> |

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" | <i>2024</i> |
|--|-------------|

Local

- | | |
|---|------------------------|
| • Member of the LOC for the Ultimate Cluster Cosmology workshop @ IAS | <i>2024</i> |
| • Co-organisation of bimonthly Cosmology team seminars | <i>2024 - 2025</i> |
| • Co-organisation of the IAS young researchers and engineers day | <i>2024 & 2025</i> |
| • Elected as doctoral student representative at the laboratory board | <i>2024 - 2025</i> |
| • Elected as doctoral student representative at the Paris-Saclay University Physics Graduate School board | <i>2023 - 2025</i> |
| • Management of the Cosmology team's conference webpage | <i>2022 - 2024</i> |

COLLABORATIONS

- | | |
|---|------------------|
| • Member of the LOCALIZATION project
<i>P.I.s: Nabila Aghanim (IAS, Paris-Saclay University) & Klaus Dolag (LMU, Munich)</i> | <i>2022-2025</i> |
|---|------------------|

GRANTS

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

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

- "Introduction to Astrophysics", meeting with 7th grade students *Apr 2025*
- "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