Sacha Guerrini

PhD Student · CEA Paris-Saclay, CosmoStat lab

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Research Experience

Université Paris Cité, CEA Paris-Saclay, CosmoStat lab, PhD student *Paris, France*

Advisor: Dr. Martin Kilbinger *Oct. 2023 - Defence in Oct. 2026*

- Development of tools for the analysis of weak gravitational lensing within the Ultraviolet Near-Infrared Optical Northern Survey (UNIONS) and the *Euclid* space mission.
- Development of tools to perform Point Spread Function (PSF) diagnostics using Galaxy-PSF correlations.
- Analysis of cosmic shear using 2-point statistics within UNIONS.
- Analysis of cosmic shear with higher-order statistics using Implicit Likelihood Inference (ILI) within UNIONS.
- Development of tools for the forward modeling of weak lensing surveys.

Stockholm University, The Oskar Klein Centre, Research intern *Stockholm, Sweden*

Advisor: Prof. Edvard Mörtsell *Apr. 2023 - Aug. 2023*

- Thesis: "Galaxy Strong Lensing and Generalized Gravity"
- Study of galaxy-galaxy strong gravitational lenses to study modified gravity effects. Development of an inference pipeline to constrain deviations from General Relativity (GR).

University of Oxford, Department of Physics, Research intern *Oxford, UK*

Advisor: Prof. James Binney, FRS *Apr. 2022 - Aug. 2022*

- Thesis: "On the vertical dynamics of galactic disks"
- Development of theoretical framework to study the vertical dynamics of galactic disks with a finite width.
- Award-winning project among the 3rd year internship at Ecole Polytechnique.

Ecole Polytechnique, Student project *Palaiseau, France*

Advisor: Dr. Carlos Matheus Silva Santos *Apr. 2020 - Apr. 2021*

- Project: "Can one hear the shape of a drum?"
- Computation of an upper bound on the eccentricity of ellipses that are determined by their spectra following Hezari and Zelditch (2019).
- Award-winning project among the 2nd year student projects at Ecole Polytechnique.

Education

Université Paris Cité, CEA, CosmoStat lab *Paris, France*

PhD in cosmology *2023 - Defence in Oct. 2026*

- *Advisor*: Dr. Martin Kilbinger
- Research in cosmology on weak gravitational lensing with the application of modern Artificial Intelligence (AI) techniques. *See details above.*

ISAE-Supaero and Université Toulouse III - Paul Sabatier *Toulouse, France*

MScT in astrophysics and space engineering *2022 - 2023*

- Engineering degree at ISAE-Supaero. Majors: Space engineering and Differential Equations
- Master of astrophysics at Université Paul Sabatier.
- Research internship at Stockholm University. *See details above*

Ecole Polytechnique *Palaiseau, France*

Engineering degree (Master's level) *2019 - 2023*

- Ingénieur Polytechnicien program (X2019)
- Majors: Mathematics and Physics
- Specialization: Astrophysics
- Research internship at the university of Oxford. *See details above*

Publications

9 publications including 2 first authors / 5 peer-reviewed journal publications / 4 preprints

Lead and Major Contributions

S. Guerrini, M. Kilbinger, H. Leterme, A. Guinot, *et al*. 2024. Galaxy-Point Spread Function correlations as a probe of weak lensing systematics with UNIONS data. A&A, 700, A215.

S. Guerrini, E. Mörtsell. 2024. Probing a scale dependent gravitational slip with galaxy strong lensing systems. Phys. Rev. D, 109, 023533.

S. Guerrini, M. Maupas, M. Kilbinger. I. UNIONS-SBI: Cosmology with cosmic shear higher-order statistics, in preparation.

M. Maupas, **S. Guerrini**, M. Kilbinger. II. UNIONS-SBI: Cosmology with cosmic shear using optimal compression with Convolutional Neural Network, in preparation.

L. Goh, **S. Guerrini**, F. Hervas-Peters, M. Kilbinger, *et al.*. UNIONS: Cosmological constraints from cosmic shear in configuration space, in preparation.

F. Hervas-Peters, **S. Guerrini**, M. Kilbinger, *et al.*. UNIONS: weak lensing catalogues and validation with image simulations, in preparation.

Contributory and Supporting Roles

N. Arendse, E. Mörtsell, L. Weisenbach, E. Hayes, *et al.*(incl. **SG**). 2025. Microlensing of lensed supernovae Zwicky & iPTF16geu: constraints on the lens galaxy mass slope and dark compact object fraction. submitted to OJAp

Other Collaborations Papers

H.L. Martin, M.J. Hudson, A. Woodfinden, L. Baumont, *et al.*(incl. **SG**). 2025. Lensing without mass: The matter density profile in cosmic voids from UNIONS. submitted to MNRAS.

S. Gwyn, A.W. McConnachie, JC. Cuillandre, K.C. Chambers, *et al.*(incl. **SG**). 2025. UNIONS: The Ultraviolet Near-Infrared Optical Northern Survey. submitted to AJ.

I. Cheng, J. Elvin-Poole, MJ. Hudson, R. Barré, *et al.*(incl. **SG**). 2025. Unions with UNIONS: Using galaxy-galaxy lensing to probe galaxy mergers. submitted to MNRAS.

C.T. Mpetha, J.E. Taylor, Y. Amoura, R. Haggar, *et al.*(incl. **SG**). 2025. Cosmology from UNIONS weak lensing profiles of galaxy clusters. MNRAS 543, 1393.

F. Hervas Peters, M. Kilbinger, R. Paviot, L. Baumont, *et al.*(incl. **SG**). 2024. UNIONS a direct measurement of intrinsic alignment with BOSS/eBOSS spectroscopy. A&A 699, A201.

Euclid Collaboration, Y. Mellier, *et al.*(incl. **SG**). 2024. Euclid. I. Overview of the Euclid mission. A&A 697, A1 (2025).

Awards, Fellowships, & Grants

2023 **PhD grant AMX**, PhD funding obtained via a scholarship of Ecole Polytechnique.

2022 **Award of the best research internship**, Research project at the University of Oxford named 'On the vertical dynamics of disks'. A dozen of projects have been awarded out of 500 students. *Palaiseau, France*

2021 **Award of the best group project**, Group research project on the spectra of the Laplacian named 'Can one hear the shape of a drum?'. Five projects out of a hundred have been awarded at Ecole Polytechnique. *Palaiseau, France*

Presentations

Contributed Presentations

S. Guerrini. 2025. Forward modelling UNIONS survey for Implicit Likelihood Inference. Oral presentation: Ecole de Physique - the dark universe, Les Houches, France

S. Guerrini. 2025. Galaxy-Point Spread Function correlations in RR2. Oral presentation: Euclid 3x2 point meeting, Paris, France.

S. Guerrini. 2025. Forward modelling UNIONS survey for Implicit Likelihood Inference. Oral presentation: COLOURS workshop, Orsay, France

S. Guerrini. 2025. UNIONS: cosmic shear in the northern sky. Departmental seminar: LPENS, Paris, France

S. Guerrini. 2025. Galaxy-Point Spread Function correlations as a probe of weak-lensing systematics with Euclid data. Flash talk: Euclid 3x2 pt developer meeting, London, UK.

S. Guerrini. 2024. Probing a scale dependent gravitational slip with galaxy strong lensing systems. Oral presentation: Rencontres de Moriond, La Thuile, Italie.

Teaching Experience

Université Paris Cité

Spring 2026	**Statistical Physics**, Teaching Assistant	*24h*
Spring 2025	**Statistical Physics**, Teaching Assistant	*24h*
Fall 2024	**Quantum Physics 1**, Teaching Assistant	*24h*
Fall 2024	**Mathematical tools for physics**, Teaching Assistant	*30h*
Fall 2023	**Mathematical tools for physics**, Teaching Assistant	*30h*

Mentoring

Spring 2025	**Matthis Maupas**, M2 research intern working on Simulation-Based Inference with UNIONS data in the CosmoStat team at CEA Paris-Saclay. (1 publication in prepartion)	*Paris, France*

Outreach & Professional Development

Collaborations

UNIONS collaboration — a wide-field, ground-based sky survey in the northern hemisphere. Contributed to the construction of the galaxy catalogue for weak lensing. Designed and implemented validation tests for galaxy shape measurement. Developed modules of the analysis pipelines for cosmological inference using weak gravitational lensing.

***Euclid* Consortium** — ESA's space-based wide-sky survey. Applied and adapted validation tests of shape measurements from UNIONS to *Euclid* data. Participated in the Weak Lensing Science Working Group, contributing to pipelines that correct for telescope systematics. Developed realistic simulations for validating measurements and the inference of cosmological parameters.

Service and Outreach

2025	**COLOURS**, LOC member of the summer school/workshop.	*Orsay, France*
2025	**Euclid 3x2 point meeting**, LOC member of the meeting.	*Paris, France*
2024-2025	**Department of astrophysics, CEA**, PhD representative.	*Paris, France*
2024	**Outreach talk to high school students**, introduction to Large-Scale Structures of the universe.	*Paris, France*

Summer schools

Ecole de Physique des Houches, one month summer school program on cosmology with lectures ranging from theory to observational tools for cosmology.

COLOURS, summer school and workshop on cosmological surveys and synergies.

Ecole d'été Rodolphe Clédassou, summer school on cosmology with an emphasis on science with the Euclid space telescope.