

BORIS BOLLIET

French, born on March 11th 1990 (33 years old)

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Assistant Teaching Professor at the University of Cambridge

Since April 2024

SZ Group Leader in *The Simons Observatory* collaboration

Member of Kavli Institute for Cosmology, Cambridge (since 2023)

Visiting Researcher at the University of Manchester (since 2021)

Member of ACT, SO, CMB-S4, LSST DESC and NIKA2 collaborations

Previous Positions:

Senior Research Associate at the DAMTP, Cambridge

September 2022 - April 2024

ERC-funded position in Blake Sherwin's group

Guest Researcher at the Flatiron Institute (CCA) in New York

March 2021 - September 2023

Research Associate at Columbia University

September 2020 - August 2022

Post-doc in Colin Hill's group

Research Associate at the University of Manchester

September 2017 - August 2020

ERC-funded position in Jens Chluba's group

Research Interests: Theoretical, Observational, Computational Cosmology and Astrophysics, Machine Learning, Thermal and kinetic Sunyaev Zeldovich Effects, Weak Lensing, CMB Spectral Distortions, Dark Matter, Dark Energy, Inflation.

Citation Summary: 44 citeable papers (31 published) - Total citations: 1,223 (1,100 published) - Citations per paper: 27.8 (35.5 published) - h-index: 21 - Link to publication list: [inspire-hep](#).

EDUCATION

Université Grenoble Alpes

September 2013 - August 2017

Grenoble, France

Ph.D. (2017), M.A. Phys. (2014)

Ph.D. Thesis: *Beyond Einstein's Theory of Gravitation: Some Aspects of Loop Quantum Cosmology, Black Holes and the Dark Universe*

Thesis Advisor: Aurélien Barrau

École Normale Supérieure de Lyon

September 2009 - August 2014

Lyon, France

S.B. Phys. (2010), M.A. Phys. (2014)

Lycée Louis-Le-Grand

September 2007 - August 2009

Paris, France

Classes Préparatoires in Physics (Selective scientific studies for the French Grandes Écoles)

OTHER POSITIONS HELD

Fulbright Fellow at Louisiana State University

August - December 2016

Baton Rouge, LA, USA

Fulbright Visiting Student Researcher

Research Project: *Non-Gaussianity in Loop Quantum Cosmology*

Advisor: Ivan Agullo

Intern at The University of Manchester

March - August 2014

Manchester, UK

Master's Thesis: *The Equation of State Approach to Cosmological Perturbations in Dark Energy*

Thesis Advisor: Richard Battye

Consultant at the French Embassy in India

July - December 2012

New Delhi, India

Project: *Report on the Scientific Landscape and Higher Education in India*

Advisor: Véronique Briquet-Laugier

Intern at Brookhaven National Laboratory

June - August 2010

Upton, NY, USA

Bachelor's Thesis: *Two-particle correlations in heavy ion collisions at RHIC*

Thesis Advisor: Paul Sorensen

HONORS AND AWARDS

Selected Participant at the Aspen Center for Physics workshop on CMB	2021
Fulbright Fellowship (~15 Grantees/year in France)	2016
Invited Young Scientist at the Lindau Nobel Laureate Meeting	2016
Diplôme de l'ENS Lyon, awarded for my work at the French Embassy in India	2014
Élève de l'ENS Lyon (~30 positions/year in Physics)	2009-2014

TEACHING EXPERIENCE

Lecturer in the MPhil in Data Intensive Science	Since 2024
Machine Learning, Statistics, Computing	
Assistant in Instruction for Part III and Part II at Cambridge	2022 - 2023
Advanced Cosmology Part III (Prof. Blake Sherwin)	
Field theory in cosmology Part III (Prof. Enrico Pajer)	
General Relativity Part II (Prof. Aron Wall)	
Modern Cosmology - Columbia Science Honors Program	2021 - 2022
New York, USA	
Saturday morning program specifically designed for selected high school students	
Teaching the full course (2h weekly)	
Invited Lecturer at the Bard Summer School On Quantum Gravity	June 2019
Bard College, Annandale-On-Hudson, NY, USA	
Lecture and Computing Lab on CMB phenomenology (~6h)	
Assistant in Instruction at Université Grenoble Alpes	2015-2017
Grenoble, France	
- Numerical Methods in Physics (Lecture and Computing Lab ~40h)	
- Special Relativity (Exercise Classes ~20h)	
- Nuclear Physics (Lab and Exercise Classes ~40h)	
- Data Analysis (Computing Lab ~20h)	

SEMINARS & CONFERENCE PRESENTATIONS

Cosmological Constraints with the thermal and kinetic Sunyaev Zeldovich effects Talks given at Kyoto TITP (invited), Yale, Princeton (invited), Stony Brook, NYU/CCA, Oxford (invited), Grenoble (invited), Geneva, Munich, Marcel Grossmann, Moriond, MPA, IAS Paris, Sesto, Aspen, in 2017-2023.

CMB Spectral Distortions from Photon Injection Processes

Talks given at Marcel Grossmann Meetings, Barcelona, CCA, Cambridge in 2018-2021.

Cosmological Perturbations in Dark Energy and Modified Gravity

Talks given at Radboud University, ENS Lyon, Marcel Grossmann, Geneva, Manchester, in 2014-2017.

Phenomenology of Loop Quantum Cosmology

Talks given at Perimeter Institute, Penn State, LSU, Erlangen, CPT Marseille, Krakow, in 2013-2017.

SERVICES TO THE PROFESSION & OUTREACH

Organizer of the CMB-France meeting (december 2023).
Organizer of Aspen workshop on cluster cosmology (Summer 2023).
Referee for *Physical Review*, *Reviews of Modern Physics* and *Classical and Quantum Gravity*.
Organizer of the cosmology journal club at DAMTP (since 2023).
Organizer of the theory seminars at Columbia (2021-22).
Organizer of the weekly Journal Club at JBCA, Manchester (2018-19).
Organizer of the weekly Student Seminars at Université Grenoble Alpes (2015-17).
Outreach Talks in schools, community centers and at private events.

SKILLS

Languages	French (Native); English (Fluent) Spanish (Conversational); Italian, Romanian, Hindi (Basics)
Coding	C/C++, Python, Tensorflow, Jupyter, Mathematica, Git, Latex Fortran, HTML
Astrophysics Software	CLASS, Cobaya, MontePython, CCL, SZFAST, CAMB, CosmoMC

COMPUTING PROJECTS

Main Author

- CLASS_SZ ([link](#)): Full-fledged parallelized cosmological inference code for CMB x LSS analyses, accelerated with neural nets.
- CLASS_EOS_FR: Cosmological perturbations in Horndeski theory
- CLASS_LQC: Primordial power spectrum and non-gaussianity in loop quantum cosmology

Co-Author

- CosmoTherm: CMB Spectral Distortions (lead: Jens Chluba, *unreleased*)
- BremsstrahlungPKG: Gaunt Factors in Astrophysics (lead: Jens Chluba, *unreleased*)
- EOS_CLASS: Cosmological Perturbations in Horndeski Models (lead: Francesco Pace)

CONTRIBUTION HIGHLIGHTS

My work is data-driven using large astrophysical datasets (e.g., maps of the CMB temperature field over the full-sky). I develop myself nearly all the models (theoretical and analytical framework) that I use for interpreting the data and implement them numerically with the best possible tools (including high performance computing and machine learning). To extract information from the data, I use statistical inference and model comparison.

- Leading two (over 16) working groups in the Simons Observatory collaboration. This involves coordinating progress on a dozen of projects carried out by our teams and leading several projects myself (e.g., Compton y -map, cluster cosmology, cluster finding algorithms, cross-correlations) and chairing monthly meetings.
- Key contributors to likelihood development for CMB analyses in ACT and SO. I have led the development of some of the most efficient and robust analyses tools in ACT and SO pipelines, including my code `class_sz`, neural network emulators for model prediction, and power spectra likelihoods. In this context my work is critical for the interpretation and parameter inference from high-resolution CMB data.
- Development of models for interpreting cross-correlations between CMB and large-scale-structure (LSS) tracers (2,3 and 4-point functions).
- Several first measurements and data analyses of CMBxLSS observables: tSZ power spectrum with *Planck* data, projected-field kSZ power spectrum, CMB spectral distortions. Involved numerically solving PDEs, performing chi-squared tests (null-tests, p-values etc.), Markov chain Monte Carlo for parameter inference, Fourier space filtering, Principal component analysis, comparison with large N-body and hydrodynamical simulations, etc.
- `class_sz` (https://github.com/CLASS-SZ/class_sz): ≈ 50 k lines in C and ≈ 10 k lines in Python. Fastest and most robust existing public code for CMBxLSS analyses. Used by groups in top universities in the US (Princeton, Columbia, Berkeley, Harvard, Chicago, ASU, UPenn), UK (Cambridge, Oxford, Manchester) and France (Paris, Grenoble) (based on communication with users and repo data).
- Analytical and numerical calculation of primordial power spectra and non-Gaussianity in bouncing cosmological models (loop quantum cosmology). Involved complex integration (e.g., Cauchy's integral theorem) and numerical resolution of ODE's.
- Analytical and numerical calculation of the probability distribution for the duration of inflation in loop quantum cosmology (Bolliet et al, CQG 34, 2017).