

Denis Werth

PhD Student in Theoretical Physics and Cosmology
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Education

Sorbonne University, Institut d'Astrophysique de Paris *2021 – present*
PhD in Theoretical Physics & Cosmology
Advisor: Prof. Sébastien Renaux-Petel

École Normale Supérieure *2020 – 2021*
MSc in Theoretical Physics
With highest honours (among top-ranked, First Class Distinction)
International Center for Fundamental Physics (ICFP)
Equivalent to Part III of the Mathematical Tripos at the University of Cambridge

École Normale Supérieure Paris-Saclay, Sorbonne University *2017 – 2019*
BSc in Fundamental Physics
With highest honours

Lycée Saint-Louis, Paris *2015 – 2017*
Classes Préparatoires aux Grandes Écoles
Intensive preparation in advanced mathematics/physics for highly selective national exams to Grandes Écoles

Research Experience prior to the PhD

Sorbonne University, Institut d'Astrophysique de Paris *2021*
Master Thesis *Advisor:* Prof. Sébastien Renaux-Petel

University of Amsterdam, Nikhef *2019 – 2020*
Pre-Doctoral Student *Advisor:* Dr. Marieke Postma

University of Cambridge, Kavli Institute for Cosmology *2019*
Long-Term Academic Visit *Advisor:* Dr. Will Handley

École Polytechnique, Laboratoire de Physique des Plasmas *2018*
Bachelor Thesis *Advisor:* Prof. Anne Bourdon

Awards, Fellowships & Grants

Herchel Smith Research Fellowship (*declined*) *2025*
University of Cambridge

Buchalter Cosmology Prize (2nd) *2024*
American Astronomical Society, Media: [INSU/CNRS](#), [IAP](#), [Sorbonne University](#)

Prize for Academic Excellence & Student Engagement *2022*
École Normale Supérieure Paris-Saclay, Media: [ENS](#), [video](#)

École Normale Supérieure PhD Scholarship *2021 – 2024*
Contrat Doctoral Spécifique Normalien (CDSN)

Gold Prize for the Île-de-France Student-Ambassador Competition *2021*
Île-de-France Region

Normalien Fellowship Prestigious status in the French academic system	<i>2017 – 2021</i>
Gold Medalist Team Math Olympiads Rouen Academy	<i>2015</i>

Grant Involvement

International Emerging Action PIs: Prof. S. Renaux-Petel and Prof. E. Dimastrogiovanni	<i>2022 – 2023</i>
ERC Starting Grant GEODESI PI: Prof. S. Renaux-Petel	<i>2018 – 2024</i>

Teaching & Mentoring

Lecturing & Tutoring

Special Relativity and Advanced Mechanics (36h) Teaching Assistant, Sorbonne University	<i>Fall 2023</i>
Mathematics for Physicists (72h) Teaching Assistant, Sorbonne University	<i>2022 – 2023</i>
Algebra I (36h) Teaching Assistant, Sorbonne University	<i>Spring 2023</i>
High School Teaching Fellow (64h) Lycée Catherine Labouré (Paris 14)	<i>2018 – 2019</i>
Resource Developed (20h) Designed & Taught new Python course in high school	<i>2018 – 2019</i>
Mathematics & Physics Tutoring Up to second year of higher education, 3h per week	<i>2017 – 2019</i>

Co-Mentoring

Arthur Poisson First-year PhD, Sorbonne University	<i>2024</i>
Nathan Belrhali Master Thesis, École Normale Supérieure	<i>2024</i>
Gela Patashuri Undergraduate, École Polytechnique	<i>2022</i>
Hugo Holland Master Thesis, École Polytechnique	<i>2022</i>

Professional Memberships & Academic Activities

<i>Since 2022</i>	Referee for Journal of Cosmology and Astroparticle Physics (JCAP)
<i>2022</i>	Part of the organising committee of the PhD Day at the Institut d'Astrophysique de Paris (IAP)
<i>Since 2022</i>	Member of LISA Consortium Cosmology Working Group

- 2022* **Organiser of the Rencontres des Jeunes Physiciens 9th Ed.**,
as member of the French Physics Society, at Collège de France (Paris)
- Since 2022* **Member of GdR Ondes Gravitationnelles**
Member of EuCAPT
Member of Committee against harassment and discrimination at IAP
Member of IOP Institute of Physics (M.Inst.P)
- Since 2021* **Member of the French Physics Society**
Active Member of Réseau Jeunes, Contributed to RPER 2021
Problems & Solutions drafting/marketing, part of the jury for Plancks competition 2021
Part of the organisation committee for Plancks French Preliminaries Competition 2023
- 2019 – 2020* **Seminar Organiser**, Master Nikhef Institute Physics Society

Selected Outreach Activities

- 14 Nov. 2022* **Invited speaker at the École Normale Supérieure (ENS)**
as alumnus of the ICFP Master Theoretical Physics track
- 4 Jun. 2022* **Nuit de l’Astronomie 2022**
Outreach interview at IAP, Member of the organisation committee
- 2021 – 2025* **Rencontres Declics**
Outreach organisation bringing researchers in high schools
- 2021* **Normale Physics Review (NPR)**
Undergraduate/student journal of physics at ENS, Participated in 5 and 6
- 2019 – 2020* **Île-de-France Student Ambassador**
Promote French higher education, research and innovation with international reach
Member of the jury for the 2020 – 2021 edition

Schools & International Experiences

Academic Visits

- Nov. 2024* **Invited Academic Research Visit**, Tsinghua University, CN
- 2022* **Extended Research Visit**, University of Groningen, NL

Summer Schools

- Summer 2022* **Rethinking Beyond the Standard Model**, Institut d’Études Scientifiques de Cargèse, FR
- March 2021* **QuantX Quantum Hackathon**, Solve Atos and IBM Challenges
- Fall 2019* **Delta Advanced Topics Courses: Machine Learning**, Delta Institute for Theoretical Physics, NL
- Summer 2018* **Rencontres d’été de Physique de l’Infiniment Grand à l’Infiniment Petit**, Paris-Saclay University, Promotion Chien-Shiung Wu

Additional Skills

- Languages* French (native), Russian (native), English (fluent), Spanish (advanced)
- Programming* **Python**: NumPy, SciPy, Pandas, Tensorflow, Keras, SymPy, Mpi4py
Mathematica, **Fortran**, Multiprocessing, HTML, CSS
- Codes Developed* CosmoFlow, CosmoPhases, ODEN
- Computing* Unix, Bash, L^AT_EX, TikZ, Zotero, Git, Office Pack, Inkscape, WordPress

<i>OS</i>	Linux (Mint), OSX
<i>Other</i>	Diploma of musical study (guitar, trombone, music theory, chamber music)

Research Dissemination

* = *Virtual Talk*

Invited Talks & Seminars

Cosmology, Gravity and Scattering Amplitudes Seminar Institut de Physique Théorique	Saclay, FR <i>23 Jan. 2025</i>
Cosmology and Astroparticle Physics Seminar Helsinki Institute of Physics	Helsinki, FI <i>15 Jan. 2025</i>
Cosmological Correlators in Taiwan Leung Center for Cosmology and Particle Astrophysics	Taipei, TW <i>3 Dec. 2024</i>
Theory Group Seminar Department of Physics, Tsinghua University	Beijing, CN <i>28 Nov. 2024</i>
Dark Energy Action Seminar* GdR co-phy	via Zoom <i>19 Nov. 2024</i>
Gravitation et Cosmologie Théoriques à l'ENS (GRACES) Seminar Department of Physics, École Normale Supérieure	Paris, FR <i>14 Nov. 2024</i>
Quantum Field Theory Group Seminar Max Planck Institute for Physics	Munich, GER <i>22 Oct. 2024</i>
High Energy & Cosmology Seminar Observatoire Astronomique de Strasbourg	Strasbourg, FR <i>28 May 2024</i>
Comission de Cosmologie de la SAF French Astronomical Society	Paris, FR <i>6 Apr. 2024</i>
Large Scale Structure & Distant Universe Seminar Institut d'Astrophysique de Paris	Paris, FR <i>5 Mar. 2024</i>
High-energy Physics & Theory Seminar Scuola Normale Superiore di Pisa	Pisa, IT <i>13 Feb. 2024</i>
GReCO Theory Group Seminar Institut d'Astrophysique de Paris and Sorbonne University	Paris, FR <i>24 Apr. 2023</i>
Cosmic Inflation and Open Quantum Systems Event French Embassy Seed Meeting	London, UK <i>23 May. 2023</i>
Theoretical Physics and Cosmology Seminar University of Groningen, Department of Physics	Groningen, NL <i>16 Dec. 2022</i>
Fundamental Interactions, Astroparticles and Cosmology Seminar University of Montpellier, Department of Physics	Montpellier, FR <i>17 Nov. 2022</i>

Conferences & Workshops

PhD day at IAP Sorbonne University	Paris, FR <i>29 Mar. 2024</i>
Multifield Cosmology (poster) Simons Center for Geometry & Physics, Stony Brook University	Stony Brook, USA <i>5 Feb. 2024</i>
Initiative in Cosmology and AstroParticle Physics Institut d'Astrophysique de Paris and Sorbonne University	Paris, FR <i>11 Jan. 2024</i>
Parity Violation from Home* Online conference	via Youtube <i>16 Oct. 2023</i>
COSMO'23 Instituto de Física Teórica	Madrid, ES <i>14 Sep. 2023</i>
Cosmology from Home* Online conference	via Youtube <i>11 Jul. 2023</i>
GDR CoPhy 2023 Sorbonne University	Paris, FR <i>5 Jun. 2023</i>
Third Annual EuCAPT Symposium CERN	Geneva, CH <i>1 Jun. 2023</i>
PhD day at IAP Sorbonne University	Paris, FR <i>12 May. 2023</i>
Progress on Old and New Themes in cosmology (PONT) Palais des Papes	Avignon, FR <i>3 May. 2023</i>
Théorie, Univers et Gravitation Workshop 2022 École de Médecine	Montpellier, FR <i>5 Oct. 2022</i>
A Cosmic Window to Fundamental Physics Instituto de Física Teórica, Panelist for the discussion “Cosmic Correlators”	Madrid, ES <i>20 Sep. 2022</i>
Rethinking Beyond the Standard Model Institut d'Études Scientifiques de Cargèse	Cargèse, FR <i>5 Aug. 2022</i>
PhD day at IAP Sorbonne University	Paris, FR <i>22 Apr. 2022</i>
56th Rencontres de Moriond 2022 Cosmology Hotel Planibel	La Thuile, IT <i>24 Jan. 2022</i>
Théorie, Universe et Gravitation Workshop 2021 Institut Henri Poincaré	Paris, FR <i>13 Dec. 2021</i>
Initiative in Cosmology and AstroParticle Physics Sorbonne University	Paris, FR <i>28 Oct. 2021</i>
Nikhef Physics Society Seminar* University of Amsterdam, Nikhef	via Zoom <i>16 Jun. 2020</i>
Nikhef Physics Society Seminar	Amsterdam, NL

University of Amsterdam, Nikhef

5 Feb. 2020

Kavli Insitute for Cosmology Seminar

Cambridge, UK

University of Cambridge, Kavli Institute for Cosmology

2 Jul. 2019

Cambridge Physics Society Seminar

Cambridge, UK

University of Cambridge, St John's College

24 Jun. 2019

Outreach & Public Talks

Internal PhD Seminar

Paris, FR

Institut d'Astrophysique de Paris

24 Nov. 2023

Internal PhD Seminar

Paris, FR

Institut d'Astrophysique de Paris

21 Apr. 2023

Science Festival 2022

Paris, FR

Sorbonne University

16 Oct. 2022

Interview for the "Nuit de l'Astronomie"

Paris, FR

IAP and Sorbonne University

4 Oct. 2022

Internal PhD Seminar

Paris, FR

Institut d'Astrophysique de Paris

25 Mar. 2021

Science Festival 2022

Paris, FR

Sorbonne University

10 Oct. 2021

Publications

* = Author List Alphabetised

+ = Awarded the 2023 Buchalter Cosmology Prize

Review: Multi-Field Inflationary Cosmology*

[25XX.XXXX]

Invited Review for Physics Reports

S. Garcia-Saenz, L. Pinol, S. Renaux-Petel, D. Werth

Primordial Sharp Features through the Nonlinear Regime

[2502.02571]

Submitted to Phys. Rev. D

C. Stahl, D. Werth, V. Poulin

Reconstructing Primordial Curvature Perturbations via SIGW with LISA

[2501.11320]

Submitted to JCAP

LISA Cosmology Working Group

Spectral Representation of Cosmological Correlators

[2409.02072]

JHEP **12** (2024) 017

D. Werth

CosmoFlow: Python Package for Cosmological Correlators

[2402.03693]

Class. Quant. Grav. **41** (2024) 17

D. Werth, L. Pinol, S. Renaux-Petel

The Cosmological Flow: A Systematic Approach to Primordial Correlators*

[2312.06559]

JCAP **02** (2025) 019

L. Pinol, S. Renaux-Petel, D. Werth

Parity Violation from Emergent Nonlocality during Inflation*

[2308.11315]

Phys. Rev. D **108** (2023) 12

S. Jazayeri, S. Renaux-Petel, X. Tong, D. Werth, Y. Zhu

Shapes of the Cosmological Low-Speed Collider*

[2307.01751]

JCAP **12** (2023) 035

S. Jazayeri, S. Renaux-Petel, D. Werth

Cosmological Flow of Primordial Correlators⁺

[2302.00655]

Phys. Rev. Lett. **133** (2024) 14

D. Werth, L. Pinol, S. Renaux-Petel

No-go Theorem for Scalar-Trispectrum-Induced Gravitational Waves*

[2207.14267]

JCAP **03** (2023) 057

S. Garcia-Saenz, L. Pinol, S. Renaux-Petel, D. Werth

Analytical Approximations for Curved Primordial Power Spectra

[2009.05573]

Phys. Rev. D **103** (2021) 2

A. Thavanesan, D. Werth, W. Handley

ODEN: Solving Differential Equations using Artificial Neural Networks*

[2005.14090]

Submitted to NeurIPS

L. Lau, D. Werth