



Dr Lucien HEURTIER

Address: 14 Durham Road,
Spennymoor DL166SH, United Kingdom

Phone : +44(0)7719164999

Email Address : Lucien.heurtier@kcl.ac.uk

Website : <https://lheurtier.github.io/>

Research

- ▶ **Oct. 2023 - Present:** Postdoctoral Research Associate, **King's College London**, UK
- ▶ **Oct. 2020 - Sept. 2023:** Postdoctoral Research Associate, **Durham University**, UK
- ▶ **Oct. 2017 - Sept. 2020:** Postdoctoral Fellowship, **University of Arizona**, USA
- ▶ **Oct. 2015 - Sept. 2017:** Postdoctoral Fellowship, **Université Libre de Bruxelles**, Belgium

Education

- ▶ **2012 –2015:** **Phd in Theoretical Physics** (Highest Honour), École Polytechnique, Palaiseau
(Supervised by Emilian Dudas)
- ▶ **2010 –2012:** **MSc in Theoretical Physics**, École Normale Supérieure (ENS) de Paris.
- ▶ **2008 –2011:** **MSc in Applied Mathematics** from ENSTA-ParisTech, Paris, France
- ▶ **2009 –2010:** **Bachelor in Fundamental Mathematics** from Université Sorbonne, France

Teaching

- ▶ **Dec. 2023 (3h):** **Lecture**, MSc *Particles, Strings and Cosmology*, Durham University
- ▶ **2021 – 2023 (32h):** **Teaching assistant**, MSc *Particles, Strings and Cosmology*, Durham University
- ▶ **July 2022 (30 min):** **Invited Lecture** - YETI 2022: *Phenomenology in the sky*, Durham University
- ▶ **2020 – 2021 (20h):** **Teaching assistant**, Foundations of Physics (Level 1), Durham University
- ▶ **Jan. 2021 (8h):** **Teaching assistant** (online), ENSTA-Paristech (France) in Statistical Physics
- ▶ **2017 – 2019 (8h):** **Substitute professor** of S. Su (undergraduate level, Quant. Mechanics) U. of Arizona
- ▶ **2015 – 2017 (8h):** **Teaching Assistant**, MSc Fundamental Physics (Introduction to QFT) ULB, Brussels
- ▶ **June 2014 (3h):** **Invited lecture** about Cosmic Inflation (SINJE, LPT Orsay, France)
- ▶ **2012 – 2015 (80h):** **Teaching assistant**, Engineer program (Ensta Paristech, Paris) in Quantum Mechanics, Astrophysics, Field Theory, and General Relativity

Supervision

- ▶ **May – Aug. 2023:** **Supervision of an MSc Student** (Ensta-Paristech, France)
Internship on the *Heat equation around evaporating primordial black holes*.
- ▶ **May – Jul. 2022:** **Supervision of an MSc Student** (Université Paris Saclay, France)
Internship on the *production of primordial black holes from inflation*, which **led to publication in Jour. of Cosmo. and Astropart. Phys.** in July 2022.
- ▶ **Mar. – Jul. 2021:** **Supervision of an MSc Student** (BITS Pilani, India)
internship on *quintessential inflation models*
- ▶ **Mar. – Jul. 2016:** **Supervision of an MSc Student** from École Polytechnique, France. Internship on the *inflaton portal to dark matter*. **Awarded as best research internship of École Polytechnique that year.**

Mentoring

- ▶ **2021 – 2023:** **Informal co-supervision of R. Heighton** (PhD student of M. Spannowsky, Durham U.)
Led to publication in Phys. Rev. D
- ▶ **2018 – 2020:** **Project supervision of F. Huang** (PhD student of K. Dienes, University of Arizona)
Led to publication in Phys. Rev. D
- ▶ **2018 – 2020:** **Project supervision of H. Song** (PhD student of S. Su, University of Arizona)
Led to publication in Jour. of High Energy Phys.
- ▶ **2015 – 2017:** **Project supervision of A. Moursy** (PhD student of S. Khalil, Zewail City Sci. Technol., Egypt)
Led to two publications in Jour. of High Energy Phys. (JHEP) and Jour. of Cosmo. and Astropart. Phys. (JCAP)

Organisational Activities

- ▶ **Jun. 2024:** Organizer of the **New Horizons for Primordial Black Hole Physics 2024** (NEHOP) workshop, Edinburgh
- ▶ **Oct. 2023:** **Chairman and discussion session animator** at the Astroparticle Symposium 2023 – Institut Pascal, Orsay, France
- ▶ **Jun. 2023:** Co-Creator and Organizer of the **New Horizons for Primordial Black Hole Physics 2023** workshop, Naples (>80 in-person participants)
- ▶ **Nov. 2022:** **Chairman** at the Astroparticle Symposium 2022 – Institut Pascal, Orsay, France
- ▶ **Nov. 2022:** **Chairman** at the Ogden at 20 conference – Durham University, UK
- ▶ **Apr. 2022:** **Parallel Session Convener** at the international Planck Conference 2022 – Paris, France
- ▶ **May 2021:** Co-Organizer and convener of the **international Planck Conference 2021**, Durham University (> 200 online participants)
- ▶ **2018 – 2020:** Organizer of the U. of Arizona **High-Energy and Gravitation Journal Club**

- ▶ **2016 – 2017:** Organizer of the **Theory Group Journal Club** and Seminar series at ULB, Brussels
- ▶ **2013 – 2015:** Creator and organiser of the **Student Seminars *Xpresso-theo*** of École Polytechnique
- ▶ **2012 – 2013:** **Administrative organizer** of a Physics lecture series at ENSTA-ParisTech, France

Referee for Peer-Reviewed Journals

Reviews requested by:

- ▶ Physical Review Letters (PRL)
- ▶ Physical Review D (PRD)
- ▶ J. of Journal of Cosmology and Astroparticle Physics (JCAP)
- ▶ Physics Letter B
- ▶ Int. J. of Modern Physics A
- ▶ SciPost Physics
- ▶ Nature Scientific Reports

External Funding

- ▶ **Jan. 2023:** Application to **University Research Fellowship** with Durham University, UK. **First round of panel selection passed successfully.**
- ▶ **Sept. 2020:** Application to **Marie Curie Fellowship** with the LPTHE, Paris. **Total Score: 82.60%**
- ▶ **Feb. 2019:** **CNRS visiting fellowships** (CPHT, France) **Funded upon competitive application**
- ▶ **July 2015:** **Visiting Grant** - PIER Short Visits 2015, DESY theory group. **Funded upon competitive application**

Outreach / Dissemination

- ▶ **Mar. 2023:** Online event **"I'm a scientist"**, elected **weekly winner** by the students
- ▶ **May 2022:** Invited presentation for the **Pint of Science 2022**, Leeds, UK
- ▶ **Mar. 2022:** Animation of the **Post Offer Day**, Durham University, UK
- ▶ **Nov. 2021:** **Dark Matter Day 2021**, virtual exhibition
- ▶ **Sept. 2018:** **Invited Tech Talk** on Big Bang Cosmology in front of young entrepreneurs, Tucson, USA

In The Press

- ▶ **Apr. 2023:** Article in **Phys.org** : [Link](#)
- ▶ **Apr. 2023:** Article in **Space.com** : [Link](#)
- ▶ **May 2023:** Article in **Universe Today** : [Link](#)

Public Engagement

- ▶ **Spring 2023:** Registered as a **STEM Ambassador** in the UK – **North East England STEM Hub (RTC North)**.

Conferences and Seminars

- ▶ **Oct. 2023:** **Invited Plenary Talk - AstroParticle Symposium 2023**, Orsay France
- ▶ **Oct. 2023:** **Invited Plenary Talk – London Cosmology Discussion Meeting**, Royal Astro. Soc., London, UK
- ▶ **May. 2023:** **Parallel Talk – Planck conference 2023**, Warsaw, Poland
- ▶ **Apr. 2023:** **Invited Seminar - University of Strasbourg**, France
- ▶ **Mar. 2023:** **Invited Seminar - Laph Annecy**, France
- ▶ **Feb. 2023:** **Invited Seminar - University of Helsinki**, Finland
- ▶ **Jan. 2023:** **Plenary Talk - UK Cosmo**, Sussex University, Brighton, UK
- ▶ **Nov. 2022:** **Invited Plenary Talk - AstroParticle Symposium 2022**, Orsay France
- ▶ **Sept. 2022:** **Invited Seminar** - University of Nottingham, UK
- ▶ **Jul. 2022:** **Parallel Talk - SUSY conference 2022**, Ioannina, Greece
- ▶ **June 2022:** **Invited Seminar** - University of Sussex, Brighton, UK
- ▶ **May 2022:** **Invited Seminar (Online)** - Bologna University, Italy
- ▶ **May 2022:** **Plenary Talk - DMUK conference**, Birmingham, UK
- ▶ **Apr. 2022:** **Parallel Talk - Planck conference 2022**, Paris, France
- ▶ **Nov. 2021:** **Invited Seminar - YITP**, USA
- ▶ **Nov. 2021:** **Plenary Talk (Online) - DMUK conference**, RAL, UK
- ▶ **Nov. 2021:** **Invited Plenary Talk (Online) - AstroParticle Symposium 2021**, Orsay France
- ▶ **Aug. 2021:** **Parallel Talk (Online) - SUSY 2021**, Shanghai, China
- ▶ **Jun. 2021:** **Plenary Talk (Online) - IRN Terascale**
- ▶ **May. 2021:** **Parallel Talk (Online) - PPC 2021**, Oklahoma, USA
- ▶ **Mar. 2021:** **Invited Seminar, LUPM**, Montpellier, France
- ▶ **Feb. 2021:** **Invited Seminar (Online), UC Irvine**, USA
- ▶ **Feb. 2021:** **Invited Seminar, LAPth**, Annecy, France
- ▶ **Oct. 2020:** **Invited Plenary Talk (Online) - CEPC workshop**, Shanghai, China
- ▶ **Apr. 2020:** **Parallel Talk - Pheno 2020**, Pittsburgh, USA
- ▶ **Feb. 2020:** **Invited Seminar, Chicago University**, USA
- ▶ **Feb. 2020:** **Invited Seminar, FermiLab**, USA,
- ▶ **Jan. 2020:** **Invited Seminar, KIAS**, Seoul, South Korea
- ▶ **Jan. 2020:** **Invited Plenary Talk - APCTP Workshop**, Pohang, South Korea
- ▶ **Nov. 2019:** **Invited Seminar - Texas A&M**, College Station, Texas, USA
- ▶ **Oct. 2019:** **Invited Seminar, DESY**, Hamburg, Germany
- ▶ **Oct. 2019:** **Plenary Talk - IRN Terascale**, ULB, Brussels, Belgium
- ▶ **Jun. 2019:** **Parallel Talk - Planck conference 2019**, Granada, Spain
- ▶ **May 2019:** **Parallel Talk - SUSY conference 2019**, Corpus Christi, Texas, USA
- ▶ **Apr. 2019:** **Invited Seminar - ASU**, Phoenix AZ, USA
- ▶ **Mar. 2019:** **Invited Seminar - ULB**, Brussels, Belgium
- ▶ **Jan. 2019:** **Invited Seminar - IBS**, Daejeon, South Korea
- ▶ **Jan. 2019:** **Invited Seminar - KIAS**, Seoul, South Korea
- ▶ **Jan. 2019:** **Invited Plenary Talk - APCTP workshop**, Pohang, South Korea
- ▶ **Jun. 2018:** **Plenary Talk - IRN Terascale**, Strasbourg, France
- ▶ **May 2018:** **Parallel Talk - Planck conference 2018**, Bonn University, Germany

- ▶ May 2018: **Parallel Talk** - **Pheno 2018**, University of Pittsburgh, USA
- ▶ Mar. 2018: **Invited Seminar** - **University of Washington**, St. Louis, USA
- ▶ Oct. 2017: **Invited Seminar** - **University of Arizona**, Tucson, USA
- ▶ Sept. 2017: **Invited Seminar** - **Université de Montpellier**, France
- ▶ Jun. 2017: **Invited Seminar** - **CPHT**, Palaiseau, France
- ▶ May 2017: **Parallel Talk** - **Planck conference 2017**, Warsaw, Poland
- ▶ Nov. 2016: **Invited Seminar** - **DESY Theory Group**, Hamburg, Germany
- ▶ Jul. 2016: **Invited Plenary Talk** - **PAI meeting**, Louvain La Neuve, Belgium
- ▶ May 2016: **Parallel Talk** - **Planck conference 2016**, Valencia, Spain
- ▶ Oct. 2015: **Invited Seminar** - **ULB**, Brussels, October 2015
- ▶ May 2015: **Parallel Talk** - **Planck conference 2015**, Ioannina, Greece
- ▶ Feb. 2015: **Invited Seminar** - **CPHT École Polytechnique**, France
- ▶ Dec. 2014: **Plenary Talk** - **GDR Terascale**, Heidelberg, Germany
- ▶ Nov. 2014: **Invited Seminar** - **ATLAS group of IFIN-HH**, Bucarest, Romania
- ▶ Sep. 2014: **Invited Seminar** - **IFAE**, Barcelona, Spain
- ▶ Sep. 2014: **Plenary Talk** - **Corfu Summer Institute**, Corfu, Greece
- ▶ Jul. 2014: **Parallel Talk** - **SUSY conference 2014**, Manchester University, UK
- ▶ May 2014: **Parallel Talk** - **Planck conference 2014**, Paris, France
- ▶ Dec. 2013: **Plenary Talk** - **JRJC (Student Conference)**, Barbasté, France
- ▶ Nov. 2013: **Plenary Talk** - **String, Cosmology and Gravity Student Conference**, Max Planck Inst., Germany
- ▶ Nov. 2013: **Plenary Talk** - **GDR Terascale**, Annecy, France
- ▶ Oct. 2013: **Plenary Talk** - **II Postgraduate Meeting on Theoretical Physics**, IFT, Madrid, Spain
- ▶ Sept. 2013: **Plenary Talk** - **Corfu Summer Institute**, Corfu, Greece
- ▶ Sept. 2013: **Invited Seminar** - **LPTHE Student Seminar**, Paris, France

Publications

Preprint Articles

- [1] S. Abel, **L. Heurtier**, *Exact Schwinger Proper Time Renormalisation*, Nov 2023 [ArXiv:2311.12102] **Submitted for publication to JHEP**
- [2] L. Hamaide, **L. Heurtier**, S.-Q. Hu, and A. Cheek, *Primordial Black Holes Are True Vacuum Nurseries*, Nov 2023 [ArXiv: 2311.01869] **Submitted for publication to PRL**
- [3] K. R. Dienes, **L. Heurtier**, F. Huang, T. M. P. Tait, and B. Thomas, *Stasis, Stasis, Triple Stasis*, Sep 2023 [ArXiv: 2309.10345] **Submitted for publication to PRD**
- [4] K. R. Dienes, **L. Heurtier**, F. Huang, D. Kim, T. M. P. Tait, and B. Thomas, *Primordial Black Holes Place the Universe in Stasis*, Dec 2022 [ArXiv:2212.01369] **Submitted for publication to PRD**

Peer Reviewed Journal Articles

- [1] A. Ghoshal, Y. Gouttenoire, **L. Heurtier**, P. Simakachorn, *Primordial Black Hole Archaeology with Gravitational Waves from Cosmic Strings*, Apr 2023, **J. High Energ. Phys.** 08 (2023) 196 [ArXiv:2304.04793]
- [2] R. Heighton, **L. Heurtier**, M. Spannowsky, *Hunting for Neutral Leptons with Ultra-High-Energy Cosmic Rays*, Mar 2023 [ArXiv:2303.11352] **Accepted for publication by PRD**
- [3] A. Cheek, **L. Heurtier**, Y. F. Perez-Gonzalez, and J. Turner, *Evaporation of Primordial Black Holes in the Early Universe: Mass and Spin Distributions*, Dec 2022 [ArXiv:2212.03878] **Accepted for publication by**

PRD

- [4] **L. Heurtier**, A. Moursy, L. Wacquez, *Cosmological Imprints of SUSY Breaking in Models of Sgoldstinoless Non-Oscillatory Inflation*, Jul 2022, **JCAP** 03 (2023) 020 [ArXiv:2207.11502]
- [5] A. Ghoshal, **L. Heurtier**, A. Paul, *Signatures of Non-thermal Dark Matter with Kination and Early Matter Domination: Gravitational Waves versus Laboratory Searches*, Aug 2022, **J. High Energ. Phys.** 2022, 105 (2022) [ArXiv:2208.01670]
- [6] A. Cheek, **L. Heurtier**, Y. F. Perez-Gonzalez, J. Turner, *Redshift Effects in Particle Production from Kerr Primordial Black Holes*, Jul 2022, **Phys. Rev. D** 106 (2022) 10, 103012 [ArXiv:2207.09462]
- [7] K. R. Dienes, **L. Heurtier**, F. Huang, D. Kim, T.M.P. Tait, B. Thomas, *Stasis in an Expanding Universe: A Recipe for Stable Mixed-Component Cosmological Eras*, Nov 2021, **Phys. Rev. D** 105 (2022) 2, 023530, [arXiv:2111.04753].
- [8] A. Cheek, **L. Heurtier**, Y. F. Perez-Gonzalez, and J. Turner, *Primordial Black Hole Evaporation and Dark Matter Production: I. Solely Hawking radiation*, Jul 2021., **Phys. Rev. D** 105 (2022) 1, 015022, Jan. 2022 **PRD Editors' Suggestion** [arXiv:2107.00013].
- [9] A. Cheek, **L. Heurtier**, Y. F. Perez-Gonzalez, and J. Turner, *Primordial Black Hole Evaporation and Dark Matter Production: II. Interplay with the Freeze-In/Out Mechanism*, Jul 2021, **Phys. Rev. D** 105 (2022) 1, 015023 Jan. 2022 **PRD Editors' Suggestion**, [arXiv:2107.00016].
- [10] **L. Heurtier**, F. Huang, and T.M.P. Tait, *Resurrecting Low-Mass Axion Dark Matter Via a Dynamical QCD Scale*, Apr. 2021, **J. High Energ. Phys.** 12 (2021) 216, [arXiv:2104.13390].
- [11] **L. Heurtier**, H.-L. Li, H. Song, S. Su, W. Su, *Precision Higgs Couplings in Neutral Naturalness Models: an Effective Field Theory Approach*, Jul 2020. **J. High Energ. Phys.** 02 (2021) 234 [arXiv:2007.15021].
- [12] E. Dudas, **L. Heurtier**, K. Olive, M. Pierre, and Y. Mambrini, *A Model of Metastable EeV Dark Matter*, Mar 2020. **Phys. Rev. D** 101 (2020) 11, 115029 [arXiv:2003.02846].
- [13] **L. Heurtier** and H. Partouche, *Spontaneous Freeze Out of Dark Matter From an Early Thermal Phase Transition*, Dec 2019. **Phys. Rev. D** 101 (2020) 4, 043527, DOI:10.1103/PhysRevD.101.043527 [arXiv:1912.02828].
- [14] **L. Heurtier**, D. Kim, J. C. Park and S. Shin, *Explaining the ANITA Anomaly with Inelastic Boosted Dark Matter*, May 30, 2019. **Phys. Rev. D** 100 (2019) no.5, 055004, DOI: 10.1103/Phys-RevD.100.055004 [arXiv:1905.13223];
- [15] **L. Heurtier** and F. Huang, *The Inflaton Portal to a Highly decoupled EeV Dark Matter Particle*, May 13, 2019. **Phys. Rev. D** 100 (2019) no.4, 043507, DOI: 10.1103/PhysRevD.100.043507 [arXiv:1905.05191];
- [16] **L. Heurtier**, Y. Mambrini and M. Pierre, *Dark matter interpretation of the ANITA anomalous events*, Dec 2018. **Phys. Rev. D** 99, no. 9, 095014 (2019) [arXiv:1902.04584].
- [17] T. Coudarchet, **L. Heurtier**, H. Partouche, *Spontaneous dark-matter mass generation along cosmological attractors in string theory*, Dec 2018. **JHEP** 1903, 117 (2019) [arXiv:1812.10134].
- [18] **L. Heurtier**, *The Inflaton Portal to Dark Matter*, July 2017. **JHEP** 1712 (2017) 072 [arXiv:1707.08999].
- [19] R. Argurio, D. Coone, **L. Heurtier**, A. Mariotti, *Sgoldstino-less inflation and low energy SUSY breaking*, July 2016. **JCAP** 1707 (2017) no.07, 047 [arXiv:1705.06788].
- [20] T. E. Gonzalo, **L. Heurtier**, A. Moursy, *Sneutrino driven GUT Inflation in Supergravity*, Sept 2016. **JHEP** 1706 (2017) 109 [arXiv:1609.09396].
- [21] **L. Heurtier**, Y. Zhang, *Supernova Constraints on Massive (Pseudo)Scalar Coupling to Neutrinos*, Sept 2016. **JCAP** 1702 (2017) no.02, 042 [arXiv:1609.05882]
- [22] **L. Heurtier**, D. Teresi, *Dark matter and observable Lepton Flavour Violation*, July 2016. **Phys. Rev. D** 94 (2016) no.12, 125022 [arXiv:1607.01798]
- [23] E. Dudas, **L. Heurtier**, C. Wieck, M. Winkler, *UV Corrections in Sgoldstino-less Inflation*, Jan 2016. **Phys. Lett. B** 759 (2016) 121-125 [arXiv:1601.03397].
- [24] I. Bena, **L. Heurtier**, A. Puhm, *AdS3: the NHEK generation*, Oct, 2015. **JHEP** 1605 (2016) 120 [arXiv:1510.08055].
- [25] O. Ducu, **L. Heurtier**, J. Maurer, *LHC signatures of a Z' mediator between dark matter and the SU(3) sector*, Sept 2015. **J. High Energ. Phys.** 1603 (2016) 006 [arXiv:1509.05615].
- [26] **L. Heurtier**, S. Khalil, A. Moursy, *Single Field Inflation in Supergravity with a U(1) Gauge Symmetry*, May

- 27, 2015. **JCAP** 1510 (2015) no.10, 045 [arXiv:1505.07366].
- [27] W. Buchmüller, E. Dudas, **L. Heurtier**, A. Westphal, C. Wieck, M. W. Winkler, *Challenges for Large-Field Inflation and Moduli Stabilization*, Jan 23, 2015. **J. High Energ. Phys.** 1504 (2015) 058 [arXiv:1501.05812].
- [28] H. Erbin, **L. Heurtier**, *Supergravity, complex parameters and the Janis-Newman algorithm*, Jan 9, 2015. **Class. Quant. Grav.** 32 (2015) no.16, 165005 [arXiv:1501.02188].
- [29] H. Erbin, **L. Heurtier**, *Five-Dimensional Janis-Newman Algorithm*, Nov 7, 2014. **Class. Quant. Grav.** 32 (2015) no.16, 165004 [arXiv:1411.2030]
- [30] W. Buchmüller, E. Dudas, **L. Heurtier** and C. Wieck., *Large-Field Inflation and Supersymmetry Breaking*, Jul 1, 2014. **J. High Energ. Phys.** 1409 (2014) 053 [arXiv:1407.0253].
- [31] E. Dudas, **L. Heurtier**, Y. Mambrini, *Generating X-ray lines from annihilating dark matter*, Apr 7, 2014. **Phys. Rev. D** 90 (2014) 035002 [arXiv:1404.1927].
- [32] E. Dudas, M. Goodsell, **L. Heurtier**, P. Tziveloglou, *Flavour models with Dirac and fake gluinos*, Dec 6, 2013. **Nucl. Phys. B** 884 (2014) 632-671 [arXiv:1312.2011]
- [33] E. Dudas, **L. Heurtier**, Y. Mambrini, B. Zaldivar, *Extra $U(1)$, effective operators, anomalies and dark matter*, Jun 28, 2013. **JHEP** 1311 (2013) 083 [arXiv:1307.0005]

Proceedings

- [1] T. Coudarchet, **L. Heurtier**, H. Partouche, *Spontaneous Freeze Out of Dark Matter*, Published in: **PoS CORFU2019** (2020) 136 - Contribution to: CORFU2019, 136. Dec 21, 2019 [arXiv:1912.10276]
- [2] **L. Heurtier**, *Extra $U(1)$, effective operators, anomalies and dark matter*, Journées de Rencontre des Jeunes Chercheurs 2013: Proceedings.