

CTPU-CGA
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Profile

Highly analytical early-career researcher in physics with teaching experience. My main research interests are phenomenology of new physics in gravity and cosmology, in particular bridging theory and observations, along with early Universe physics and General Relativity. I am a member of the LISA consortium where I am co-chair of the early-career scientist working group.

Education & Academic Positions

- **Senior Researcher** Daejeon, Korea
 Cosmology, Gravity, and Astroparticle Physics Group, IBS CTPU April 2024 - Present
- **CNES Postdoctoral Fellow** Paris, France
 SYRTE, Observatoire de Paris December 2022 - April 2024
- **Postdoctoral Researcher** Seoul, Korea
 Centre for Quantum Spacetime (CQUeST), Sogang University August 2021 - October 2022
 – Remote part-time November 2020 - August 2021
- **Ph.D. in Physics** Warsaw, Poland
 National Centre for Nuclear Research September 14, 2020
 – Title of thesis: *Aspects of Lorentz and CPT Violation in Cosmology*
 – Supervisor: Mariusz P. Dąbrowski
- **MSc. Engineering physics** Lund, Sweden
 Lund Institute of Technology June 15, 2015
 – Title of thesis: *Astrophysical Probes of Models of Quantum Gravity*
 – Supervisor: John Ellis

Publications

Refereed Journal Articles

- Bum-Hoon Lee, Wonwoo Lee, Hocheol Lee, **N.A.Nilsson**, Somyadip Thakur
Induced Cosmological Anisotropies and CMB Anomalies by a non-Abelian Gauge-Gravity Interaction
 Phys.Dark Univ. 46 (2024) 101601
- **N.A.Nilsson**
Dynamical dark energy from spacetime-symmetry breaking and Late-time behaviour and phantom crossing
 Phys.Dark Univ. 45 (2024) 101515
- Ewa Czuchry, **N.A.Nilsson**
Energy flow of λ in Hořava-Lifshitz cosmology
 Phys.Rev.D 110 (2024) 4, 043502

- Hocheol Lee, Bum-Hoon Lee, Wonwoo Lee, **N.A.Nilsson**, Somyadip Thakur
On the Dynamical Generation and Decay of Cosmological Anisotropies
Phys.Dark Univ. 44 (2024) 101476
- **N.A.Nilsson**, Christophe Le-Poncin Lafitte
Reexamining aspects of spacetime-symmetry breaking with CMB polarization
Phys.Rev.D 109 (2024) 1, 015032
- Quentin G. Bailey, Alexander S. Gard, **N.A.Nilsson**, Rui Xu, Lijing Shao
Classical radiation fields for scalar, electromagnetic, and gravitational waves with spacetime-symmetry breaking
Annals Phys. 461 (2024) 169582
- **N.A.Nilsson**, Christophe Le-Poncin Lafitte
Spacetime-symmetry breaking effects in gravitational-wave generation at the first post-Newtonian order
Phys.Rev.D 109 (2024) 2, 024035
- **N.A. Nilsson**, Eleonora Di Valentino, Mu-In Park
A new test of dynamical dark energy models and cosmic tensions in Hořava gravity
Mon.Not.Roy.Astron.Soc. 519 (2023) 4, 5043-5058
- **N.A. Nilsson**
Explicit Spacetime-Symmetry Breaking and the Dynamics of Primordial Fields
Phys.Rev.D 106 (2022) 10, 104036, arXiv:2205.00496
- **N.A. Nilsson**, Mu-In Park
Tests of Standard Cosmology in Hořava Gravity
Eur.Phys.J. C, 82, 873 (2022), arXiv:2108.07986
- K.O'Neil Ault, Q.B.Bailey, **N.A. Nilsson**,
3+1 Formulation of the Standard-Model Extension Gravity Sector
Phys.Rev.D 103 (2021) 4, 044010, I.F 4.83
- **N.A. Nilsson**
Preferred-frame Effects, the H_0 tension, and Probes of Hořava-Lifshitz Gravity,
Eur.Phys.J.Plus 135 (2020) 4, 361, I.F 2.612
- **N.A.Nilsson**, E.Czuchry
Hořava-Lifshitz Cosmology in Light of New Data
Phys.Dark Univ. C23 (2019) 100253, I.F 6.509
- **N.A.Nilsson**, M.Dąbrowski
Energy Scale of Lorentz Violation in Rainbow Gravity
Phys.Dark Univ. 18 (2017) 115-122 , I.F 5.425
- M.Fairbairn, **N.A.Nilsson**, J.Ellis, J.Hinton, R.White
The CTA Sensitivity to Lorentz-Violating Effects on the Gamma-Ray Horizon
JCAP 1406 (2014) 005, I.F 5.81

Articles under review or in preparation

- Quentin G. Bailey, Kellie O'Neal-Ault, **N.A.Nilsson**
You shall not pass! – explicit diffeomorphism violation "no-go" results
arXiv:2407.04918, under review at PRD

Conference Proceedings

- **N.A.Nilsson**
SME Gravity in the Early Universe
arXiv:2206.07925, Citations: 1
- **N.A.Nilsson**, K.O'Neil Ault, Q.B.Bailey
A 3+1 Decomposition of the Minimal Standard-Model Extension Gravitational Sector
CPT and Lorentz Symmetry, pp. 198-200 (2020), Citations: 4

Other Publications

- B. Jones, G. Burns, H.V. Cavanagh, D. Findlay, S. Karbassi, **N.A. Nilsson**, G. Skoro, P.N.M Wright, 2021
Unexpected ^{13}N concentrations in ISIS synchrotron room air
Applied Radiation and Isotopes 182 (2022) 110139, IF 1.513
- N.A. Nilsson
Incentives, Rewards, and Recognition - What Really Motivates a Researcher?
First prize essay published for the MDPI essay contest Judging Research - How Should Research and Researchers Be Evaluated and Rewarded?
ISBN 978-3-03928-314-9
- N.A. Nilsson
Commodity or Public Property?
Essay published for the MDPI essay contest The Global Benefits of Open Research
ISBN 978-3-03897-009-5

Awards and Honours

- 2019: Winner of the MDPI English Writing Competition for the essay "*Incentives, Rewards and Recognition - What Really Motivates a Researcher?*", 460 EUR
- 2019: NCBJ Award for Outstanding Achievements for PhD Students, 600 EUR
- 2018: NCBJ Award for Outstanding Achievements for PhD Students, 600 EUR

Grants and Fellowships

- 2022: CNES Postdoctoral Fellowship (France) (accepted)
- 2022: JSPS Postdoctoral Fellowship (Japan), 3 years (declined)
- 2022: FONDECYT Postdoctoral Fellowship (Chile), 3 years (declined)
- 2018: PI and sole applicant for NCBJ Young Scientist Grant MNiSW 212737/E-78/M/2018, Title: Tensor Lorentz Violation in Cosmology with Antisymmetric Tensor Fields, 3300 EUR

Invited Talks

- "Cosmological anisotropies and parity-violation effects from dual interactions"
CQeST Seminar, Sogang University
Seoul, Korea
May 30, 2024
- "Wave Solutions and Post-Newtonian Aspects of Spacetime-Symmetry Breaking"
Third Workshop on Theoretical Aspects of the Standard-Model Extension
Bloomington, USA
January 27, 2024

- **“Spacetime-Symmetry Breaking in Gravitational-Wave Generation”**
Second IUCSS Workshop on Gravitational Aspects of Lorentz Violation
Bloomington, USA
March 14, 2023
- **“Aspects of Explicit Spacetime-Symmetry Breaking”**
Szczecin University Cosmology Group Seminar
Szczecin, Poland
December 17, 2021
- **“Testing General Relativity with Spacetime Symmetries”**
The 63rd Workshop on Gravity and Cosmology
Pohang, Korea
November 16, 2021
- **“Aspects of Lorentz Violation in Gravity & Cosmology”**
Paris Observatory
Paris, France
October 17, 2019
- **“Successes and Problems of the Λ CDM Model”**
Embry-Riddle Aeronautical University
Prescott, USA
April 4, 2019
- **“Quantum Gravity, Lorentz Violation, and Rainbows”**
University of Szczecin
Szczecin, Poland
December 9, 2016

Physics Meetings

Oral Contribution

- **“Cosmic Birefringence in Light of Discrete Symmetries”**
Light Dark World 2024
Daejeon, Korea
August 13, 2024
- **“Extra Polarisation of Gravitational Waves from Spacetime-Symmetry Breaking”**
LISA Symposium 2024
Dublin, Ireland
July 11, 2024
- **“Recent results in explicit breaking”**
Fifth SME Summer School and Workshop
Bloomington, USA
May 14, 2024
- **“Spacetime Symmetries in the Early Universe”**
Paris workshop on primordial black holes and gravitational waves
Paris, France
November 28, 2023
- **“Spacetime-Symmetry Breaking and the Generation of Gravitational Waves”**
XXV SIGRAV Conference on General Relativity and Gravitation
Trieste, Italy
September 8, 2023
- **“Testing Spacetime Symmetries in the Early Universe”**
Cosmology from Home 2023
Online
July 4, 2023
- **“Cosmic Birefringence - Implications for Fundamental Physics”**
Moriond Gravitation 2023
La Thuile, Italy
March 23, 2023
- **“SME Gravity in the Early Universe”**
Ninth Meeting on CPT and Lorentz Symmetry
Bloomington, USA
May 19, 2022
- **“Spacetime Symmetries in the Early Universe”**
The 30th Workshop on General Relativity and Gravitation in Japan
Waseda, Japan
December 7, 2021
- **“Degrees of Freedom for Explicit Symmetry Breaking”**
AAPPS-DACG Workshop 2021
Pohang, Korea
October 5, 2021
- **“Ongoing Efforts in Testing Spacetime Symmetries”**
CQeST Workshop 2021
Gangneung, Korea
September 25, 2021
- **“ADM Spacetime Splitting of the Gravitational SME”**
Workshop on Gravitational Aspects of Lorentz Violation
Bloomington, USA
March 14, 2021

- **“Ongoing Efforts to Constrain Lorentz Violation in Gravity”**
Spring Workshop on Gravity and Cosmology
Krakow, Poland
May 26, 2020
- **“Antisymmetric Tensors in Friedmann Cosmology”**
6th Conference of the Polish Society of Relativity
Szczecin, Poland
September 23, 2019
- **“A 3+1 Decomposition of the SME Gravity Sector”**
Eighth Meeting on CPT and Lorentz Symmetry
Bloomington, USA
May 12, 2019
- **“Hořava-Lifshitz Gravity in Light of New Data”**
Testing Gravity 2019
Vancouver, Canada
January 23, 2019
- **“Cosmological Evolution in Lorentz Breaking Gravity”**
IUCSS Summer School on the Lorentz and CPT violating SME
Bloomington, USA
June 15, 2018
- **“Toward Quantum Gravity Phenomenology”**
Singularities in General Relativity and their Quantum Fate
Warsaw, Poland
May 21, 2018
- **“Probing Hořava-Lifshitz Cosmology”**
SpringCosmo18
Zeuten, Germany
May 19, 2018
- **“Searching for Lorentz Invariance Violation in Theories with Modified Dispersion Relations”**
3rd Azores School on Observational Cosmology
Azores, Portugal
August 27, 2017
- **Theories with Modified Dispersion Relations**
“SpringCosmofun 17”
Międzyzdroje, Poland
May 19, 2017

Meetings Organised

- **LISA Analysis Tools Workshop**
Online
April 15-18, 2024
- **Sixth Conference of the Polish Society of Relativity**
Szczecin, Poland
September 23-26, 2019
- **Singularities in General Relativity and their Quantum Fate**
Warsaw, Poland
May 21-25, 2018

Research Visits

- **University of Sheffield**
Visiting Dr Eleonora Di Valentino
Sheffield, UK
July 13-19, 2024
- **Embry-Riddle Aeronautical University**
Visiting Professor Quentin G. Bailey
Prescott, USA
January 25-31, 2020
- **Lagrange Institute**
Visiting Professor Patrick Peter
Paris, France
October 21-25, 2019
- **Embry-Riddle Aeronautical University**
Visiting Professor Quentin G. Bailey
Prescott, USA
April 3-18, 2019

Teaching and Supervising Experience

- **Supervisor** - BSc. course: Structure of the Universe,
– Project title: *“Successes and problems of the Λ CDM model”*
SYRTE, Paris, France
November 2023 - Present

- **Co-supervisor** - MSc. level summer student, SYRTE, Paris, France
– Project title: *“Two-body problem in relativistic field theory”* Summer 2022
- **Teaching Assistant** - Electrodynamics (PhD course) NCBJ, Warsaw, Poland
Autumn 2019
- **Student project supervisor** - Supervised a group of high-school students building a 3D printer. Pimlico, London, UK
2015-2016

Academic appointments and Service

- Elected chair of the LISA consortium early-career scientist working group (LECS) 2023 - Present
- Member of the GWECS (Gravitational-Wave Early-Career Scientists) council 2023 - Present
– Co-organised the GWECS Job Fair 2022 and 2023
- Reviewer for journals such as Physical Review D.
- Involved in the outreach program “Her Teach Future” at Lund Institute of Technology. 2013

Non-Academic Experience

- **ISIS Duty Technician** Harwell, United Kingdom
Rutherford Appleton Laboratory 2020 - 2021
- **Physics Science Technician** London, United Kingdom
Pimlico Academy 2015-2016
- **Research Engineer - Radiation Safety** Lund, Sweden
MAX IV Laboratory 2014-2015
- **Summer Student** Harwell, United Kingdom
Diamond Light Source June-September 2013
- **Tutor in Mathematics** Helsingborg, Sweden
January-June 2013

Language & IT

- Computers/IT
 - Windows, Ubuntu Linux & Debian Linux
 - MS Word & Excel
 - L^AT_EX
 - Mathematica: xAct, Markov-Chain Monte Carlo cluster computations
 - Python: numpy, scipy, matplotlib, pandas, seaborn, scikit-learn, image processing
- Languages
 - **Native level:** Swedish, English. **Average:** French. **Beginner:** Polish level A1+