

Joonas Nättilä

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Sex: Male

Born: June 25th, 1989, Tornio, Finland

Nationality: Finnish Citizen

Languages: Finnish (native), English, Swedish

Nordita

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Research interests

Computational physics: fluid and plasma dynamics, high performance computing, numerical methods.

High-energy astrophysics: neutron stars, X-ray bursts, equation of state; black holes, accretion; relativity, ray tracing.

Statistics: Bayesian inference, Monte Carlo methods.

Professional experience

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| 2018 –2019 | Nordita Fellow , Nordita, Stockholm, Sweden. |
| 2016 | Nordita Visiting Ph.D. Fellow , Nordita, Stockholm, Sweden. |

Education

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| 2014–2017 | Ph.D. in Astrophysics (with honours) , University of Turku, Finland.
Supervisor: Prof. Juri Poutanen, Director of Tuorla Observatory. |
| 2012–2013 | M.Sc. in Astronomy , University of Oulu, Finland. |
| 2008–2012 | B.Sc. in Physics , University of Oulu, Finland. |

Teaching

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| Summer 2017 | Lecturer, High Performance Computing Summer School , CSC, Finland. |
| Summer 2016 | Lecturer & tutor for Finnish IT Center for Science HPC Summer School. |
| Summer 2015 | |
| Spring 2017 | Lecturer, Software tools in Physics , University of Turku, Finland. |
| Spring 2016 | Lecturer of the “Introduction to Unix” section of the course (3 ECTS). |
| Spring 2015 | |
| Fall 2016 | Teaching Assistant, Optics , University of Turku, Finland.
Exercise assistant of Optics course (6 ECTS). |
| Summer 2013 | Teaching Assistant, Thermophysics , University of Oulu, Finland. |
| Summer 2012 | Exercise assistant of Thermophysics summer course (6 ECTS). |
| Summer 2011 | |
| Summer 2012 | Teaching Assistant, Electricity and Magnetism , University of Oulu, Finland.
Exercise assistant of Electricity and Magnetism summer course (4 ECTS). |
| 2011 – 2012 | Assistant, Laboratory Exercises in Physics 1 , University of Oulu, Finland.
Assistant in Laboratory Exercises in Physics 1 (3 ECTS), in the fall and spring semesters. |
| Summer 2011 | Teaching Assistant, Mathematics of Physics , University of Oulu, Finland.
Exercise assistant of Mathematics of Physics summer course (6 ECTS). |
| Summer 2011 | Teaching Assistant, Waveforms and Optics , University of Oulu, Finland. |
| Spring 2011 | Exercise assistant of Waveforms and Optics (6 ECTS) in spring and summer courses. |

Mentoring & Supervision

Co-supervised 2 M.Sc. thesis, 1 B.Sc thesis.

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| 2015–2017 | Jere Kuuttila , M.Sc. thesis research project, University of Turku, Finland.
X-ray burst time evolution dependency on the spectral state. |
| 2015–2016 | Tuomo Salmi , M.Sc. thesis research project, University of Turku, Finland.
Neutron star mass and radius constraints from pulse profile modeling. |
| 2014–2015 | Jere Kuuttila , B.Sc. thesis research project, University of Turku, Finland.
X-ray bursts as standard candles. |

Memberships

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| 2016– | eXTP Dense Matter science working group |
| 2015– | ESA XIPE satellite Science Team (SWG2.2 Accreting Millisecond Pulsars) |
| 2014– | Organizing committee for CSC HPC Summer Schools |
| 2013– | JuliaLang organization |
| 2012– | Finnish Astronomical Society |

Presentations & Talks

4 invited, 14 contributed talks.

Invited:

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| 2017 | Holographic dense QCD and neutron stars , ENS, Paris. |
| 2016 | From quarks to gravitational waves: Neutron stars as a laboratory for fundamental physic , CERN. |
| 2016 | COSPAR 2016, E1.1: Accreting Neutron Stars and Stellar-mass Black Hole , Istanbul, Turkey. (<i>Conference canceled!</i>) |
| 2016 | JINA-CEE Symposium: Neutron Stars in the Multi-Messenger Era , Ohio, USA. |

Contributed:

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| 2017 | Astrophysics Seminar , Helsinki, Finland. |
| 2017 | Exascale thinking of particle energization problems , Nordita, Sweden. |
| 2016 | INT-16-2b: Phases Of Dense Matter Workshop , Seattle, USA. |
| 2016 | Nordita Workshop on accretion onto magnetized neutron stars , Stockholm, Sweden. |
| 2015 | Workshop on Relativistic Astrophysics , Kavalto, Finland. |
| 2015 | University of Maryland, Colloquium speaker , Washington, USA. |
| 2015 | University of Tennessee, Colloquium speaker , Tennessee, USA. |
| 2015 | The Neutron Star Radius, And All That Jazz , Montreal, Canada. |
| 2015 | 40 years of X-ray bursts: Extreme explosions in dense environments , Madrid, Spain. |
| 2014 | ESAC (visiting scientist presentation) , Madrid, Spain. |
| 2014 | Physics of Neutron Stars Conference , St. Petersburg, Russia. |
| 2014 | Astronomers' Days , Savonlinna, Finland. |
| 2013 | European Week of Astronomy and Space Science , Turku, Finland. |
| 2012 | Astronomers' Days , Porvoo, Finland. |

Funding

Research

- 2015–2017 | **UTUGS Physical and Chemical Sciences funded 3yr. Ph.D. scholarship**
Constraining neutron star mass and radius.
- 2014–2015 | **~ 23 000 eur Väisälä Foundation grant**
Magnetar atmosphere models: breaking the barrier between observations and theory

Travel

- 2016 | **~ 1 000 eur CERN** From quarks to gravitational waves workshop.
- 2016 | **~ 2 000 eur Magnus Ehrnrooth Foundation** JINA-CEE symposium (Ohio) and COSPAR 2016 (Istanbul).
- 2016 | **~ 1 000 eur UTUGS Physical and Chemical Sciences** JINA-CEE symposium (Ohio).
- 2016 | **~ 2 000 eur ESAC** Visiting scientist (host: Jari Kajava).
- 2015 | **~ 1 000 eur UTUGS Physical and Chemical Sciences** The Neutron Star Radius, and All That Jazz -conference, Montreal.
- 2015 | **~ 1 000 eur ESAC** 40 years of X-ray bursts - conference.
- 2014 | **~ 1 000 eur ESAC** Research visit (host: Jari Kajava).
- + Some smaller travel grants.

Conference organization

- 2017 | **Nordita Workshop: Exascale thinking of particle energization problems**, Stockholm, Sweden.
Member of the scientific and local organizing committee.
- 2015 | **Workshop on Relativistic Astrophysics**, Kavalto, Finland.
Member of the local organizing committee.
- 2015 | **PCS Annual Seminar day**, University of Turku, Finland.
Chairman & member of the organizing committee.

Public outreach

My research has been presented in various local (Finnish) media: [tiedetuubi.fi \(30.11.2016\)](#), [Turun Sanomat \(10.11.2017\)](#), [Turkulainen \(10.11.2017\)](#), [Tähdet & Avaruus \(25.11.2017\)](#), [Aamuset \(8.12.2017\)](#), [Tekniikka & Talous \(8.12.2017\)](#), [Verkkouutiset \(8.12.2017\)](#). And in international media: [Cosmos 27.11.2017](#).

Open source software

Bender, ray tracing code, general relativistic ray tracing code for computing radiation from rapidly rotating oblate neutron stars. <https://github.com/natj/bender>

Hydro, modular 2d hydrodynamical code with unsplitted HLLC Riemann solver, second order Runge-Kutta time-stepping, and linear piecewise reconstruction. <https://github.com/natj/hydro>

CellularAutomata.jl, Julia library for elementary and totalistic Cellular automata modeling. <https://github.com/natj/CellularAutomata.jl>

Publications

11 publications, 142 citations; h-index 6, g-index 11, i10-index 5 ([ADS](#)).

Peer-reviewed scientific articles

- [11] **J. Nättilä** and P. Pihajoki. Radiation from rapidly rotating oblate neutron stars. *A&A submitted*, September 2017, [[arXiv:1709.07292](#)].
- [10] **J. Nättilä**, M. C. Miller, A. W. Steiner, J. J. E. Kajava, V. F. Suleimanov, and J. Poutanen. Neutron star mass and radius measurements from atmospheric model fits to X-ray burst cooling tail spectra. *A&A*, 608:A31, December 2017, [[arXiv:1709.09120](#)].
- [9] V. F. Suleimanov, J. J. E. Kajava, S. V. Molkov, **J. Nättilä**, A. A. Lutovinov, K. Werner, and J. Poutanen. Basic parameters of the helium-accreting X-ray bursting neutron star in 4U 1820-30. *MNRAS*, 472:3905–3913, December 2017, [[arXiv:1708.09168](#)].
- [8] J. J. E. Kajava, K. I. I. Koljonen, **J. Nättilä**, V. Suleimanov, and J. Poutanen. Variable spreading layer in 4U 1608-52 during thermonuclear X-ray bursts in the soft state. *MNRAS*, *submitted*, 2017, [[arXiv:1707.09479](#)].
- [7] J. Kuuttila, J. J. E. Kajava, **J. Nättilä**, S. E. Motta, C. Sánchez-Fernández, E. Kuulkers, A. Cumming, and J. Poutanen. Flux decay during thermonuclear X-ray bursts analysed with the dynamic power-law index method. *A&A*, 604:A77, August 2017, [[arXiv:1705.05653](#)].
- [6] V. F. Suleimanov, J. Poutanen, **J. Nättilä**, J. J. E. Kajava, M. G. Revnivtsev, and K. Werner. The direct cooling tail method for X-ray burst analysis to constrain neutron star masses and radii. *MNRAS*, 466:906–913, April 2017, [[arXiv:1611.09885](#)].
- [5] J. J. E. Kajava, **J. Nättilä**, J. Poutanen, A. Cumming, V. Suleimanov, and E. Kuulkers. Detection of burning ashes from thermonuclear X-ray bursts. *MNRAS*, 464:L6–L10, January 2017, [[arXiv:1608.06801](#)].
- [4] **J. Nättilä**, A. W. Steiner, J. J. E. Kajava, V. F. Suleimanov, and J. Poutanen. Equation of state constraints for the cold dense matter inside neutron stars using the cooling tail method. *A&A*, 591:A25, June 2016, [[arXiv:1509.06561](#)].
- [3] **J. Nättilä**, V. F. Suleimanov, J. J. E. Kajava, and J. Poutanen. Models of neutron star atmospheres enriched with nuclear burning ashes. *A&A*, 581:A83, September 2015, [[arXiv:1507.01525](#)].
- [2] J. J. E. Kajava, **J. Nättilä**, O.-M. Latvala, M. Pursiainen, J. Poutanen, V. F. Suleimanov, M. G. Revnivtsev, E. Kuulkers, and D. K. Galloway. The influence of accretion geometry on the spectral evolution during thermonuclear (type I) X-ray bursts. *MNRAS*, 445:4218–4234, December 2014, [[arXiv:1406.0322](#)].
- [1] J. Poutanen, **J. Nättilä**, J. J. E. Kajava, O.-M. Latvala, D. K. Galloway, E. Kuulkers, and V. F. Suleimanov. The effect of accretion on the measurement of neutron star mass and radius in the low-mass X-ray binary 4U 1608-52. *MNRAS*, 442:3777–3790, August 2014, [[arXiv:1405.2663](#)].

Theses

- [3] **J. Nättilä**. X-ray bursts as a tool to constrain the equation of state of the ultra-dense matter inside neutron stars. PhD thesis, University of Turku, Finland, 2017. [ISBN:978-951-29-7057-5](#).
- [2] **J. Nättilä**. Mass and radius constraints for neutron stars using the cooling tail method. Master's thesis, University of Oulu, Finland, 2013. [oulu-201312041966](#).
- [1] **J. Nättilä**. Spectral analysis of X-ray bursts from neutron stars: IGR J1747–2721 (*Neutronitähtien röntgenpurkaukset ja niiden spektrianalyysi: IGR J1747–2721*). Bachelor's thesis, University of Oulu, Finland, 2012.