CONTACT DETAILS

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Research Interests

- Neutron Stars: macroscopic quantum states, rotational and magnetic field evolution, pulsar glitches, pulsar population synthesis, laboratory analogues, superfluidity's impact on cooling, continuous gravitational-wave emission, precession
- **Machine Learning**: deep / multi-modal / active learning for parameter estimation in astrophysics, simulation-based inference, deep learning for pulsar detection and classification, interpretability and insights into decision making of deep learning algorithms

Superfluidity: multi-fluid magnetohydrodynamics, mesoscopic vortex physics, Gross–Pitaevskii and Ginzburg–Landau-type models, phase transitions, superfluid helium, ultra-cold gases

ACADEMIC HISTORY

- Future Leaders Fellow and Proleptic Senior Lecturer in Physics, RHUL, Egham, UK (since Oct 2024)
- Senior Lecturer in Data Science, University of Hertfordshire, Hatfield, UK (Feb Sept 2024)
- Juan de la Cierva Incorporación Fellow, Inst. of Space Sciences, Barcelona, ES (May 2022 Feb 2024)
- Senior Postdoctoral Researcher, Institute of Space Sciences, Barcelona, ES (Jan 2020 Feb 2024)
- McGill Space Institute Fellow, McGill University, Montréal, CA (Oct 2016 Dec 2019)

EDUCATION

PhD, Mathematical Sciences, University of Southampton, UK (Sept 2016)

- Advisor: Prof. Nils Andersson
- Thesis Title: Cosmic Condensates Vortex, Fluxtube and Neutron Star Dynamics

Diplom (MPhys), Physics, University of Tübingen, DE (Mar 2012)

- Advisors: Dr. Kostas Glampedakis, Prof. Kostas Kokkotas
- Major, Minor: Astronomy & Astrophysics, Quantum Optics
- Thesis Title: Dynamics of Superfluid Neutron Stars

Research Experience

Future Leaders Fellow and Proleptic Senior Lecturer in Physics, RHUL, Egham, UK (since Oct 2024)

- Principal Investigator of Future Leaders Fellowship grant
- Simulation-based inference for pulsar glitches in the Square Kilometre Array era
- Exploring laboratory condensates as analogues for cosmic superfluidity
- Development of reproducible, open-source scientific software tools

Senior Lecturer in Data Science, University of Hertfordshire, Hatfield, UK (Feb – Sept 2024)

- Sequential simulation-based inference approaches for pulsar population synthesis
- 3D computational fluid dynamics simulations of neutron star interiors

Juan de la Cierva Incorporación Fellow, Inst. of Space Sciences, Barcelona, ES (May 2022 – Feb 2024)

- Advisor: Dr. Nanda Rea
- Macroscopic and mesoscopic magnetic field evolution approaches for neutron star interiors
- Ginzburg-Landau models for magnetic flux distributions in superconducting neutron star cores

Research Experience (Continued)

Senior Postdoctoral Researcher, Institute of Space Sciences, Barcelona, ES (Jan 2020 – Feb 2024)

- *Advisor*: Dr. Nanda Rea
- Leading the Pulsar Population Synthesis work package for the ERC project MAGNESIA
- Developing a new population synthesis framework for isolated pulsars in Python
- Implementing neural networks for population synthesis including simulation-based inference
- Multi-wavelength analyses and simulations of ultra-long period radio pulsars

McGill Space Institute Fellow, McGill University, Montréal, CA (Oct 2016 – Dec 2019)

- Advisors: Prof. Andrew Cumming, Prof. Vicky Kaspi
- Working at the interface of astrophysics and condensed-matter physics
- Developing macroscopic models for pulsar glitches with consistent crustal microphysics
- Bayesian approaches for astrophysical parameter inferences

Doctoral Researcher, General Relativity, University of Southampton, UK (Oct 2012 - Aug 2016)

- Advisor: Prof. Nils Andersson
- Superfluid and superconducting neutron star core physics
- Generalised magneto-hydrodynamics models for superconducting neutron star interiors
- Analysing terrestrial quantum condensates as versatile neutron star analogues

Undergraduate Researcher, Theor. Astrophysics, University of Tübingen, DE (Mar 2011 – Mar 2012)

- Advisors: Dr. Kostas Glampedakis, Prof. Kostas Kokkotas
- Modelling the post-glitch response based on viscous, magnetic and mutual friction coupling

Intern, Inst. of Planetary Research, German Aerospace Center (DLR), Berlin, DE (July – Aug 2009)

- Advisor: Dr. Ute Böttger
- Recording and analysing Raman spectra of rock samples to assess spectrometer stability
- Developing criteria for a database of Mars analogue material

Undergraduate Researcher, Solid State Physics, University of Tübingen, DE (June 2009 – Dec 2010)

- Advisor: Prof. Thomas Dahm
- Conformal mapping to determine magnetic field distributions of rectangular superconductors

Intern, EADS Astrium GmbH (now Airbus Defence & Space), Friedrichshafen, DE (Aug – Sept 2006)

- Advisor: Dr. Achim Seidel
- Calculating the Earth's magnetic field to study its influence on atomic clocks on satellites

VISITING SCIENTIST POSITIONS

- Sept 2019: Aspen Center for Physics, Aspen, Colorado, US
- Nov Dec 2018: OzGrav Visitor, Monash University / University of Melbourne, AU
- Jan & Apr 2018: School of Mathematics, Statistics and Physics, Newcastle University, UK

Research Grants, Fellowships, and Scholarships (£2,504,500 in Total)

- Oct 2024 Sept 2028: Future Leaders Fellowship, UK Research and Innovation, UK; £2.18M (PI)
- May 2022 Apr 2025: Juan de la Cierva Fellowship, Agencia Estatal de Investigación, ES; £85,000 (PI)
- Apr 2023 Dec 2024: SGR-Cat 2021, Generalitat de Catalunya, ES; £53,000 (PI)
- Oct 2016 Aug 2019: McGill Space Inst. Postdoctoral Fellowship, McGill Space Inst., CA; £115,000 (PI)
- Jan 2013 Dec 2015: PhD Scholarship, Evangelisches Studienwerk e.V. Villigst, DE; £40,000 (PI)
- Oct 2012 Sept 2015: Vice Chancellor Scholarship, University of Southampton, UK; £18, 500
- Nov 2012 Oct 2013: PhD Scholarship, German Academic Exchange Service (DAAD), DE; £13,000 (PI)

Personal Awards and Travel Grants (£4,200 in Total)

- July 2019: *Travel grant* for the 69th Lindau Nobel Laureate Meeting dedicated to Physics, CA; £2, 200 (nominated by Nobel Laureate Dr. Arthur McDonald and selected in a worldwide competition)
- July 2019: First Poster Prize, voted by the participants of the 69th Lindau Nobel Laureate Meeting, DE
- Nov Dec 2018: International Visitor Grant, OzGrav, AU; £2,000
- June 2015: Best Student Talk Prize, Annual NewCompStar Conference, Budapest, HU
- Mar 2015: SET for BRITAIN finalist, poster competition in the UK Parliament, London, UK

Invited Colloquia, Seminars, and Talks (34 in Total)

- May 2025: Talk, ECT* Workshop, Trento, IT
- March 2025: Gravity Seminar, University of Southampton, UK
- March 2025: Particle Physics and Astronomy Seminar, RHUL, UK
- Jan 2025: Webinar, UK Quantum Fluids Network, UK
- Jan 2025: Panelist, GW Analysis in the Era of ML, RAS Specialist Discussion Workshop, London, UK
- July 2024: Plenary Talk, General Meeting, Spanish Astronomical Society, Granada, ES
- June 2024: Talk, XMM-Newton 2024 Science Workshop, Madrid, ES
- Nov 2023: Astrophysics Seminar, Centre for Astrophysics Research, University of Hertfordshire, UK
- Nov 2023: Astrophysics Seminar, Institute for Astronomy, University of Tübingen, DE
- Oct 2023: Geo/Astrophysical Fluid Dynamics Seminar, University of Colorado Boulder, US (online)
- June 2023: Seminar, Physics, Royal Holloway, University of London, UK (online)
- May 2023: Astronomy Seminar, University of East Anglia, UK
- July 2022: Seminar, Fluid Dynamics, Newcastle University, UK (online)
- May 2021: Talk, Journal Club, CAMK, Warsaw, PL (online)
- Mar 2021: Seminar, Hadronic, Nuclear & Atomic Physics Group, University of Barcelona, ES (online)
- Nov 2020: Talk, Neutron Star Group Meeting, University of Southampton, UK (online)
- Nov 2020: Webinar, Fluids ECR Forum, University of Leeds, UK (online)
- Nov 2020: Astronomy Seminar, Stony Brook University, New York, US (online)
- July 2020: Colloquium, Research Training Group Models of Gravity, Oldenburg, DE (online)
- June 2020: Astrophysics Seminar, IRAP, Toulouse, FR (online)
- Feb 2020: Physics Colloquium, Texas A&M Commerce, Texas, US
- Apr 2019: Talk, ICONS, JINA CEE Workshop, University of Amsterdam, NL
- Apr 2019: Talk, Quantum Turbulence, INT Workshop, Seattle, Washington, US
- Jan 2019: Talk, Mini-Symposium on GWs and QCD, Goethe University, Frankfurt, DE
- Nov 2018: Astrophysics Colloquium, Swinburne University, Melbourne, AU
- Nov 2018: Astrophysics Seminar, University of Melbourne, AU
- Nov 2018: Talk, GW UniversityGroup Meeting, Monash University, Melbourne, AU
- Apr 2018: Superfluid Seminar, Newcastle University, UK
- Apr 2018: MHD Seminar, Durham University, UK
- Mar 2018: Astrophysics Seminar, McGill University, Montréal, CA
- Jan 2018: Astrophysics Seminar, Newcastle University, UK
- Jan 2018: Gravity Seminar, University of Southampton, UK
- Nov 2017: Condensed Matter & Astrophysics Seminar, Northwestern University, Evanston, Illinois, US
- Nov 2017: Physics Colloquium, Kent State University, Ohio, US

Contributed Seminars, Talks, and Posters (27 in Total)

- Jan 2025: Poster, Quantum Technologies for Fundamental Physics (QTFP) Meeting, Glasgow, UK
- Sept 2024: Talk, Extreme Matter in Extreme Stars Workshop, Leiden, NL
- Sept 2024: Talk, SPINS-UK, University of Southampton, UK

Contributed Seminars, Talks, and Posters (Continued)

- July 2024: Talk, International Conference on Quarks and Nuclear Physics, Barcelona, ES
- Nov 2023: Talk, SPINS-UK, University of Oxford, UK
- Jan 2023: Talk, Institute of Space Sciences Strategy Retreat, Montserrat, ES
- June 2022: Talk, EAS Meeting 2022, Valencia, ES
- June 2021: Talk, EAS Meeting 2021, Leiden, NL (online)
- Nov 2020: Pizza Seminar, Institute of Space Sciences, Barcelona, ES (online)
- July 2020: Talk, Physics of Neutron Stars 2020, St. Petersburg, RU (cancelled due to Covid-19)
- Mar 2020: Talk, Annual PHAROS Conference, Patras, GR (cancelled due to Covid-19)
- Nov 2019: Talk, MAGNESIA Kick-Off Meeting, Institute of Space Sciences, Barcelona, ES
- July 2018: Talk, COSPAR 42nd Assembly, Pasadena, California, US
- Apr 2018: Talk, PHAROS WG2 Meeting, CAMK, Warsaw, PL
- Nov 2017: Talk, Neutron Star Crusts, JINA INT Workshop, Seattle, Washington, US
- Oct 2017: Talk, New Perspectives on Neutron Star Interiors, ECT* Workshop, Trento, IT
- Sept 2017: Talk, Trottier Family Foundation Showcase, McGill University, Montréal, CA
- May 2017: Talk, SMFNS2017, Havana/Varadero, CU
- June 2016: Talk, AstroGrav Pizza Lunch, University of Southampton, UK
- June 2015: Talk, Annual NewCompStar Conference, Budapest, HU
- Apr 2015: Talk, BritGrav15, University of Birmingham, UK
- Jan 2015: Talk, Observations & Theory in the Dynamics of NS, ECT* Workshop, Trento, IT
- Dec 2014: Applied Maths Postgraduate Seminar, University of Southampton, UK
- Mar 2014: Talk, BritGrav14, University of Cambridge, UK
- July 2013: Poster, School on Gravitational Waves, Banach Center, Warsaw, PL
- June 2013: Applied Maths Postgraduate Seminar, University of Southampton, UK
- Apr 2012: GR & Astrophysics Seminar, University of Tübingen, DE

TEACHING (208 LECTURE HOURS IN TOTAL)

University of Hertfordshire, Department of Physics, Astronomy and Mathematics, UK

- Spring & summer 2024: 7PAM2002 Data Science Project (MSc level; supervisor)
- Summer 2024: 7PAM2015 Research Methods in Data Science (MSc level; lecturer)
- Spring 2024: 7PAM2016 Advanced Research Topics in Data Science (MSc level; lecturer)

Institute of Space Sciences & Autonomous University of Barcelona, Department of Physics, ES

- Spring 2021/2022/2023: Neutron Stars, Black Holes & Gravitational Waves (MSc level; lecturer)
- July 2021: ICE Annual Summer School on AI for Astronomy (MSc/PhD level; lecturer)

McGill University, Department of Physics, Montréal, CA

- June 2019: CRAQ Annual Summer School on Stellar Astrophysics (MSc/PhD level; lecturer)
- *Spring 2019*: PHYS 434 Optics (BSc level; module leader & lecturer)
- Autumn 2018: PHYS 352 Electromagnetic Waves, PHYS 521 Astrophysics (BSc level; guest lecturer)
- Autumn 2017: PHYS 632 Seminar in Astrophysics (MSc/PhD level; module leader & instructor)
- Spring 2017: PHYS 432 Physics of Fluids (BSc level; guest lecturer)

University of Southampton, Mathematical Sciences, UK

- Spring 2014/2015: MATH1007 Mathematical Methods For Physicists (BSc level; teaching assistant)
- *Autumn 2012/2013/2014/2015*: MATH1052 Differential Equations (BSc level; teaching assistant)
- Autumn 2012/2013: MATH2045 Vector Calculus & Complex Variables (BSc level; teaching assistant)
- Spring 2014: MATH3006 Relativity, Black Holes & Cosmology (BSc level; teaching assistant)

TEACHING (CONTINUED)

University of Tübingen, Department of Physics, DE

- 2008 2012: PP2 Experimental Physics II (BSc level; instructor & lecturer)
- Spring 2012: VFKOS Observational Cosmology (MSc level; teaching assistant)
- Autumn 2011: VFHAP High Energy Astrophysics (MSc level; teaching assistant)

SUPERVISION

Postdoctoral Researchers

• Dr Michele Ronchi (co-supervised with N. Rea), Institute of Space Sciences, ES (2024)

PhD Students

- Celsa Pardo Araujo (co-supervised with N. Rea), Institute of Space Sciences, ES (since 2021)
- Michele Ronchi (*cum laude*; co-supervised with N. Rea), Institute of Space Sciences, ES (2020 2023)

MSc Students

- Zoë Fowler, Institute of Space Sciences, ES (2022/2023)
- Marco Ermolli (co-supervised with D. Viganò), Institute of Space Sciences, ES (2020/2021)
- Étienne Camphius, McGill University, CA (2019)

BSc Project Students

- Nora Malgeri, RHUL, UK (spring 2025)
- Eric Amill Ferré, Institute of Space Sciences, ES (spring 2021)
- Claudia Bielecki, McGill University, CA (2019)
- Aveen Mahon, McGill University, CA (spring 2019)
- Jean-Michel Cauchy-Delli Gatti, McGill University, CA (summer 2017)

PROFESSIONAL SERVICES AND LEADERSHIP

- since 2020: Mentor, Evangelisches Studienwerk e.V. Villigst, DE
- Oct 2020 Feb 2024: Chair, Pizza Seminars, Institute of Space Sciences, ES
- Sept 2020 Sept 2023: Member (chair 2022/2023), Equity Committee, Institute of Space Sciences, ES
- Oct Nov 2022: Instructor, ECR Workshop on Postdoc Application Writing, Inst. of Space Sciences, ES
- July 2020 Aug 2022: Organiser, Machine Learning Journal Club, Institute of Space Sciences, ES
- Oct 2016 Dec 2019: Member, AstroMcGill (McGill Space Institute Outreach Team), CA
- May Aug 2019: Instructor, McGill Space Institute Student Workshops, McGill University, CA
- June 2017 May 2019: Co-organiser, McGill Space Institute Seminars, McGill University, CA
- Aug Dec 2018: Organiser, Postdoctoral Personal Development Workshops, McGill University, CA
- May Aug 2018: Instructor, McGill Space Institute Student Workshops, McGill University, CA
- Oct 2014 Aug 2016: Organiser, Applied Maths Postgraduate Seminar, University of Southampton, UK

Reviewing and Refereeing Activities

- since 2017: Reviewer for scientific journals (A&A, ApJ, APSS, MNRAS, Nature, PRD, PRL)
- March 2025: Observer, Cross Research Council Responsive Mode, UK Research and Innovation, UK
- Feb March 2025: Evaluator, FLF Selection Panel Member for Round 10, RHUL, UK
- Nov 2022: PhD thesis committee, Ricard Aguilera-Miret, University of the Balearic Islands, ES
- Sept 2022: PhD thesis committee, Laura Cabayol García, Autonomous University of Barcelona, ES
- 2021: External reviewer, Early Career Scheme, Research Grants Council of Hong Kong, CN
- 2020: External reviewer, OPUS Funding Scheme, National Science Center, PL
- 2017: External reviewer Junior Leader Grant Competition, BASIS Foundation, RU

Scientific Meeting Organisation

- Autumn 2025: LOC & SOC, SPINS-UK Meeting, RHUL, UK
- July 2024: Invited Convener, 10th International Conference on Quarks & Nuclear Physics, Barcelona, ES
- Nov 2022: LOC, 3rd ATHENA Conference, Barcelona, ES
- May 2022: LOC & SOC, Annual PHAROS Conference, Rome, IT
- July 2021: LOC & SOC, Institute of Space Sciences 4th International Summer School on AI, ES (online)
- Mar 2020: SOC, Annual PHAROS Conference, Patras, GR
- Dec 2019: Invited Convener, 30th Texas Symposium on Relativistic Astrophysics, Portsmouth, UK

Membership in Large Collaborations

- since March 2025: New Athena Collaboration, Compact Objects & Transients Working Groups
- since June 2024: BRIDGCE, UK Galactic Chemical Potential and Nuclear Astrophysics network
- since Sept 2022: Einstein Telescope (ET) Collaboration, Nuclear Physics & Transient Sources Divisions
- since Feb 2020: International Research Network for Nuclear Astrophysics (IReNA)
- since Feb 2019: Joint Institute for Nuclear Astrophysics (JINA CEE)
- since Jan 2018: Square Kilometre Array (SKA) Collaboration, Pulsar Working Group (Associate Member)
- Mar 2022 Feb 2024: AIHUB, Artificial Intelligence initiative of Spain's National Research Council
- Nov 2017 May 2022: PHAROS (European COST Action CA16214)
- Nov 2013 Nov 2017: NewCompStar (European COST Action MP1304)

Membership in Scientific Societies

- since June 2022: Junior Member, International Astronomical Union (IAU)
- since Mar 2021: Ordinary Member, European Astronomical Society (EAS)
- since Feb 2021: Leadership Team, Inclusion, Diversity & Equity in European Astronomy (IDEEA)
- since Oct 2014: *Member*, Institute of Physics (IoP)
- since Jan 2010: *Member*, German Physical Society (DPG)
- Oct 2016 Dec 2019: Member, Le Centre de recherche en astrophysique du Québec (CRAQ)

OUTREACH

- March 2025: Public lecture on Neutron Star Hiccups & the Secrets They Reveal, UK Science Week, RHUL
- Jan 2024: Virtual interview on Neutronensterne with German Year 11 high school students
- Apr 2022: Interview on Neutronensterne for the German Astronomy and Space Science podcast raumzeit
- Mar Aug 2021: Scientific advisor for the short film *Pulsars: A tale of cosmic clocks*, which highlights the work of Dame Jocelyn Bell Burnell and won the first prize at the Science in Action 2022 competition
- Feb 2021: Virtual secondary school talk on *Being a Theoretical Astrophysicist* for the 100tífiques initiative on the International Day of Girls and Women in Science, Barcelona, ES (online)
- Oct 2020: Webinar on *Neutron Stars The Strongest Magnets in the Universe* as part of NASA's Universe of Learning program, USA (online)
- July 2020: Public lecture on *Wenn Neutronensterne Schluckauf haben* (in German) as part of the Faszination Astronomie Online series, Haus der Astronomie, Heidelberg, DE (online)
- July 2020: Public lecture on *Neutron Stars Extraordinary Cosmic Laboratories* for SEDS Celestia (Astronomy & Astrophysics Club, BITS Pilani K. K. Birla Goa Campus), Goa, IN (online)
- **Dec 2018:** Public lecture on *Neutron Stars Extraordinary Cosmic Laboratories* as part of the Public AstroNight series, AstroMcGill, Montréal, CA
- Nov 2018: Science Storytelling Slam hosted by the Broad Science Initiative, Montréal, CA
- Nov 2018: Mentor and judge at the 3rd Annual McGill Physics Hackathon, Montréal, CA
- Oct 2018: Secondary school talk on Our Solar System, Schillerschule, Tuttlingen, DE
- Sept 2017: Astronomy on Tap talk on Neutron Stars A Space Odyssey, Montréal, CA

OUTREACH (CONTINUED)

- Aug 2017: Solar eclipse viewing for thousands of spectators, McGill University, Montréal, CA
- Mar 2016: Southampton Science and Engineering Festival, University of Southampton, UK
- Nov 2015: Einstein's Legacy (outreach event for college students), QMUL, UK
- Mar 2015: Southampton Science and Engineering Day, University of Southampton, UK
- Mar 2014: The Big Bang Fair (science fair for secondary school students), Birmingham, UK
- Mar 2013: Southampton Science and Engineering Day, University of Southampton UK

Additional Writing

- Article, *The 69th Lindau Nobel Laureate Meeting*, News & Events McDonald Institute (Aug 2019) https://mcdonaldinstitute.ca/news/lino19/
- Blog post, 10 Questions with Vanessa Graber, Women in Research (June 2019) https://womeninresearchblog.wordpress.com/2019/06/26/vanessa-germany/

Selected Press

- Nov 2024: Physicists Spot Quantum Tornadoes Twirling in a 'Supersolid', Quanta Magazine
- Aug 2024: A team of astronomers offer new insights into the evolution of pulsars, ICE Press Release
- Feb 2024: The 80s called, they want their ultra-long period radio transient back, astrobites
- June 2023: Probing the mysteries of neutron stars with a surprising earthly analog, Knowable Magazine
- Sept 2022: *How (S)low Can You Go: Pulsar Edition, AAS Nova*
- Dec 2020: Superfluid used to make sounds that might be heard in neutron star, New Scientist
- June 2020: NASA discovers youngest 'cosmic baby' neutron star, Independent
- June 2020: Astronomers just discovered the youngest ever 'baby' dead star, CNet
- June 2020: Astronomers find baby pulsar a rare magnetar born just 240 years ago, Astronomy Now
- June 2020: Astronomers Discover Youngest Magnetar Ever, Sci News
- June 2020: Hallan estrella 'bebé' que explica origen de las explosiones en el universo, La Vanguardia
- Aug 2019: Pulsar glitch suggests superfluid layers lie within neutron star, Physics World
- Aug 2019: Wenn Neutronensterne aus dem Takt geraten, Spektrum
- Aug 2019: A Glitch In A Neutron Star Allowed Astronomers To 'Peek' At Its Interior, IFL Science
- Aug 2019: A Radio Glitch Reveals The Structure Of A Neutron Star, Forbes
- Aug 2019: Patient astronomers crack the code of super-dense spinning stars, The Age

Additional Training

Teaching Techniques for Instructors Workshop, McGill University, Montréal, CA (Sept 2017)

- *Details:* One day workshop organised by the T-PULSE Initiative
- Topics: Writing course syllabi, organising content, creating learning objectives, giving feedback.

Career and Leadership Development Course, University of Southampton, UK (Feb 2015)

- Details: Two-day intensive residential course run by the University's Doctoral College
- *Topics:* Developing a personal leadership style, improving understanding of career planning.

Management and Leadership Course, Furtwangen University, DE (Apr – Sept 2009)

- Details: Initiative by the Ba-Wü Foundation to support 20 outstanding female STEM students
- *Topics:* Improving management, communication and leadership skills through online training modules and on-site seminars, completing a marketing project in collaboration with a local company.