

CONTACT DETAILS

Institute of Space Sciences (ICE-CSIC, IEEC)
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RESEARCH INTERESTS

Neutron Stars: macroscopic quantum states, rotational and magnetic field evolution, pulsar glitches, laboratory analogues, superfluidity impacting on cooling, pulsar population synthesis, precession, continuous gravitational wave emission

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

Machine Learning: deep learning and multi-modal learning for parameter estimation in astrophysics, deep learning for pulsar detection, Gaussian mixture models for pulsar classification, interpretability and insights into decision making of deep-learning algorithms

EDUCATION

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

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

Diplom (MPhys), Physics, Eberhard Karls University, Tübingen, Germany (Mar 2012)

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

RESEARCH EXPERIENCE

Postdoctoral Researcher, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (since Jan 2020)

- *Focus:* Developing a new machine-learning based approach for population synthesis analyses of isolated neutron stars that are visible as pulsars across the electromagnetic spectrum as part of the ERC project [MAGNESIA](#) – The Magnetar Census
- *Advisor:* Dr. Nanda Rea

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

- *Focus:* Working on the interface of astrophysics and condensed matter physics by studying implications of superfluid and superconducting components on neutron star observables
- *Advisors:* Prof. Andrew Cumming, Prof. Vicky Kaspi

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

- *Focus:* Studying properties of superfluid and superconducting neutron star cores and analysing how well-known terrestrial quantum condensates can serve as versatile analogues of neutron stars
- *Advisor:* Prof. Nils Andersson

Undergraduate Research Assistant, Theoretical Astrophysics, Eberhard Karls University, Tübingen, Germany (Mar 2011 – Mar 2012)

- *Project:* Developing a model for the response of the neutron star core following a spin glitch that accounts for viscous and magnetic coupling as well as vortex-mediated mutual friction
- *Advisors:* Dr. Kostas Glampedakis, Prof. Kostas Kokkotas

RESEARCH EXPERIENCE (CONTINUED)

Undergraduate Research Assistant, Theoretical Solid State Physics, Eberhard Karls University, Tübingen, Germany (July 2009 – Dec 2010)

- *Project*: Calculating magnetic field distributions of rectangular superconducting samples using conformal mapping with the aim to optimise designs of microtraps for ultra-cold atomic gases
- *Advisor*: Prof. Thomas Dahm

Intern, Institute of Planetary Research, DLR, Berlin, Germany (July – Aug 2009)

- *Project*: Recording and analysing Raman spectra of rock samples to assess the spectrometer's stability and developing criteria for a database of Mars analogue material
- *Advisor*: Dr. Ute Böttger

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

- *Project*: Calculating the Earth's magnetic field to study its influence on clocks as part of the Atomic Clock Ensemble in Space mission aimed at better measuring gravity's effects on time
- *Advisor*: Dr. Achim Seidel

FELLOWSHIPS, GRANTS AND AWARDS

- **Juan de la Cierva Incorporación Postdoctoral Fellowship**, 97,800 € (starting May 2022) (PI)
- **McGill Space Institute Postdoctoral Fellowship**, 130,175 € (Oct 2016 – Aug 2019) (PI)
- **Travel grant for the 69th Lindau Nobel Laureate Meeting dedicated to Physics**, 2,500 € (July 2019) (nominated by Nobel Laureate Dr. Arthur McDonald and selected in a worldwide competition)
- **First Poster Prize**, voted by the participants of the 69th Lindau Nobel Laureate Meeting (July 2019)
- **International Visitor Grant, OzGrav**, Australia, 2,250 € (Nov – Dec 2018)
- **PhD Scholarship**, Evangelisches Studienwerk e.V. Villigst, 45,000 € (Jan 2013 – Dec 2015) (PI)
- **Vice Chancellor Scholarship**, University of Southampton, 21,400 € (Oct 2012 – Oct 2015)
- **Best Student Talk Prize**, Annual NewCompStar Conference, Budapest (June 2015)
- **SET for BRITAIN finalist**, poster competition in the UK Parliament, London (Mar 2015)
- **PhD Scholarship**, German Academic Exchange Service (DAAD), 15,150 € (Nov 2012 – Nov 2013) (PI)

VISITING SCIENTIST

- Aspen Center for Physics, Aspen, Colorado (Sept 2019)
- OzGrav Visitor, Monash University / University of Melbourne, Australia (Nov – Dec 2018)
- School of Mathematics, Statistics and Physics, Newcastle University, UK (Jan and Apr 2018)

INVITED COLLOQUIA, SEMINARS AND TALKS

- **Talk**, Journal Club, CAMK, Warsaw, Poland (May 2021) (online)
- **Seminar**, Hadronic, Nuclear & Atomic Physics Group, University of Barcelona, Spain (Mar 2021) (online)
- **Talk**, Neutron Star Group Meeting, University of Southampton, UK (Nov 2020) (online)
- **Webinar**, Fluids ECR Forum, University of Leeds, UK (Nov 2020) (online)
- **Astronomy Seminar**, Stony Brook University, New York (Nov 2020) (online)
- **Colloquium**, Research Training Group – Models of Gravity, Oldenburg, Germany (July 2020) (online)
- **Seminar**, IRAP, Toulouse, France (June 2020) (online)
- **Physics Colloquium**, Texas A&M Commerce, Texas (Feb 2020)
- **Talk**, ICONS, JINA – CEE Workshop, University of Amsterdam, Netherlands (Apr 2019)
- **Talk**, *Quantum Turbulence*, INT Workshop, Seattle, Washington (Apr 2019)
- **Talk**, *Mini-Symposium on GWs and QCD*, Goethe University, Frankfurt, Germany (Jan 2019)
- **Astrophysics Colloquium**, Swinburne University, Melbourne, Australia (Nov 2018)
- **Astrophysics Seminar**, University of Melbourne, Australia (Nov 2018)

INVITED COLLOQUIA, SEMINARS AND TALKS (CONTINUED)

- **GW Group Meeting**, Monash University, Melbourne, Australia (Nov 2018)
- **Superfluid Seminar**, Newcastle University, UK (Apr 2018)
- **MHD Seminar**, Durham University, UK (Apr 2018)
- **Astrophysics Seminar**, McGill University, Montréal, Canada (Mar 2018)
- **Astrophysics Seminar**, Newcastle University, UK (Jan 2018)
- **Gravity Seminar**, University of Southampton, UK (Jan 2018)
- **Condensed Matter & Astrophysics Seminar**, Northwestern University, Evanston, Illinois (Nov 2017)
- **Physics Colloquium**, Kent State University, Ohio (Nov 2017)

CONTRIBUTED SEMINARS, TALKS AND POSTERS

- **Talk**, EAS Meeting 2021, Leiden, Netherlands (June 2021) (online)
- **Pizza Seminar**, Institute of Space Sciences (ICE-CSIC), Barcelona, Spain (Nov 2020) (online)
- **Talk**, Physics of Neutron Stars 2020, St. Petersburg, Russia (July 2020) (cancelled due to Covid-19)
- **Talk**, Annual PHAROS Conference, Patras, Greece (Mar 2020) (cancelled due to Covid-19)
- **Talk**, MAGNESIA Kick-Off Meeting, Institute of Space Sciences (ICE-CSIC), Barcelona (Nov 2019)
- **Talk**, COSPAR 42nd Assembly, Pasadena, California (July 2018)
- **Talk**, PHAROS WG2 Meeting, CAMK, Warsaw, Poland (Apr 2018)
- **Talk**, *Neutron Star Crusts*, JINA – INT Workshop, Seattle, Washington (Nov 2017)
- **Talk**, *New Perspectives on Neutron Star Interiors*, ECT* Workshop, Trento, Italy (Oct 2017)
- **Talk**, Trottier Family Foundation Showcase, McGill University, Montréal, Canada (Sept 2017)
- **Talk**, SMFNS2017, Havana/Varadero, Cuba (May 2017)
- **Talk**, AstroGrav Pizza Lunch, University of Southampton, UK (June 2016)
- **Talk**, Annual NewCompStar Conference, Budapest, Hungary (June 2015)
- **Talk**, BritGrav15, University of Birmingham, UK (Apr 2015)
- **Talk**, *Observations & Theory in the Dynamics of NS*, ECT* Workshop, Trento, Italy (Jan 2015)
- **Applied Maths Postgraduate Seminar**, University of Southampton, UK (Dec 2014)
- **Talk**, BritGrav14, University of Cambridge, UK (Mar 2014)
- **Poster**, School on Gravitational Waves, Banach Center, Warsaw, Poland (July 2013)
- **Applied Maths Postgraduate Seminar**, University of Southampton, UK (June 2013)
- **GR & Astrophysics Seminar**, Eberhard Karls University, Tübingen, Germany (Apr 2012)

TEACHING EXPERIENCE

Lecturer, Faculty of Sciences, Autonomous University of Barcelona, Spain (since May 2021)

- *Course*: Neutron Stars, Black Holes & Gravitational Waves (graduate level)
- *Responsibilities*: Design lecture content and homework exercises for the above module as part of the master's program on 'High Energy Physics, Astrophysics & Cosmology'. I am currently responsible for the sections on 'Black Hole Theory' as well as 'Gravitational Wave Theory'.

Lecturer, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (July 2021)

- *Course*: ICE Annual Summer School on 'Artificial Intelligence for Astronomy' (graduate level)
- *Responsibilities*: Design lecture content on 'Deep Learning & Neural Networks' as well as hands-on exercises on 'Scikit-learn & Clustering Algorithms' for a school targeted at master and PhD students

Lecturer, Department of Physics, McGill University, Montréal, Canada (June 2019)

- *Course*: CRAQ Annual Summer School on 'Stellar Astrophysics'
- *Responsibilities*: Design lecture content on the topic of 'Stellar Death – Neutron Stars' and a hands-on exercise on 'Mass-radius Relations' for a school targeted at master and PhD students

TEACHING EXPERIENCE (CONTINUED)

Lecturer, Department of Physics, McGill University, Montréal, Canada (Jan – Apr 2019)

- *Course*: PHYS 434 Optics (undergraduate level)
- *Responsibilities*: Design content for the modules ‘Electromagnetism & Light Propagation’, ‘Geometric Optics’, ‘Superposition, Polarisation & Interference’, ‘Diffraction, Fourier Optics & Modern Optics’, homework exercises and exams, lecture, grade and supervise teaching assistants as the lead instructor

Guest Lecturer, Department of Physics, McGill University, Montréal, Canada (Sept – Oct 2018)

- *Courses*: PHYS 352 Electromagnetic Waves, PHYS 521 Astrophysics (undergraduate level)
- *Responsibilities*: Cover lectures on ‘Light Propagation in Media’ and ‘Compact Binaries’

Instructor, Department of Physics, McGill University, Montréal, Canada (Sept – Dec 2017)

- *Course*: PHYS 632 Seminar in Astrophysics (graduate-level reading course)
- *Responsibilities*: Choose reading materials on the topic of ‘Astrophysical Transients’, stimulate and guide discussions in weekly meetings, answer questions and grade students

Guest Lecturer, Department of Physics, McGill University, Montréal, Canada (Mar 2017)

- *Course*: PHYS 432 Physics of Fluids (undergraduate level)
- *Responsibilities*: Give an introduction to superfluids and their role in neutron star astrophysics

Teaching Assistant, Mathematical Sciences, University of Southampton, UK (Oct 2012 – May 2016)

- *Courses*: MATH1007 Mathematical Methods For Physical Scientists, MATH1050 Maple Labs, MATH1052 Differential Equations, MATH2045 Vector Calculus & Complex Variables, MATH3006 Relativity, Black Holes & Cosmology (undergraduate level)
- *Responsibilities*: Run weekly problem classes, answer questions, mark coursework and tests

Undergraduate Teaching Assistant, Institute of Astronomy & Astrophysics, Eberhard Karls University, Tübingen, Germany (Mar 2011 – Apr 2012)

- *Course*: VFHAP High Energy Astrophysics, VFKOS Observational Cosmology (graduate level)
- *Responsibilities*: Create electronic lecture notes for the instructor Prof. Andrea Santangelo

Undergraduate Teaching Assistant, Institute of Physics, Eberhard Karls University, Tübingen, Germany (Oct 2008 – Apr 2012)

- *Course*: PP2 Experimental Physics II (undergraduate level)
- *Responsibilities*: As one of two instructors for five optics experiments, I maintained the equipment, gave a one-hour lecture for each experiment, supervised the students and marked their reports. The course was offered four times a year and taken by about 30 students each round.

MENTORING EXPERIENCE

Co-supervisor, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (since Jan 2022)

- *Responsibilities*: Co-supervisor of machine learning engineer and PhD student Celsa Pardo Araujo working on applying deep learning to astrophysical problems including pulsar population synthesis

Mentor, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (since Oct 2021)

- *Responsibilities*: Mentor for PhD student Eloy Peña-Asensio working on computational quantum simulation of physicochemical properties of meteorites and other extraterrestrial materials

Co-supervisor, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (since Jan 2020)

- *Responsibilities*: Official co-supervisor of PhD student Michele Ronchi working on applying deep learning to pulsar population synthesis within the ERC project MAGNESIA

MENTORING EXPERIENCE (CONTINUED)

Supervisor, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (Feb – June 2021)

- *Responsibilities*: Official supervisor of one undergraduate student working on applying clustering machine-learning models to the observed population of pulsars

Co-supervisor, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, Spain (Nov 2020 – July 2021)

- *Responsibilities*: Official co-supervisor of master student Marco Ermolli who studied the impact of superfluidity and superconductivity as well as relevant microphysics on neutron star cooling

Supervisor, Department of Physics, McGill University, Montréal, Canada (Jan – Nov 2019)

- *Responsibilities*: Primary mentor for two undergraduate students working on neutron star astrophysics related research projects and master student Etienne Camphius who wrote Python code to numerically solve and analyse the Ginzburg–Landau equations

Instructor, McGill Space Institute, McGill University, Montréal, Canada (May – Sept 2019)

- *Topics*: ‘Interacting with your Research Group’, ‘Applying for Grad School’, ‘Non-academic Careers’
- *Responsibilities*: Organise and run personal development workshops for undergraduates

Instructor, McGill Space Institute, McGill University, Montréal, Canada (May – Sept 2018)

- *Topics*: ‘Talking to your Research Advisor’, ‘Highs & Lows of Research’, ‘Non-academic Careers’
- *Responsibilities*: Organise and run personal development workshops for undergraduates

Supervisor, Department of Physics, McGill University, Montréal, Canada (May – Sept 2017)

- *Responsibilities*: Primary mentor for one undergraduate summer student writing Python code to calculate model equations of state for the neutron star interior

COLLABORATIONS, MEMBERSHIPS AND PROFESSIONAL SERVICES

- **SOC**, [Annual PHAROS Conference](#), Rome, Italy (May 2022)
- **Member**, European Astronomical Society ([EAS](#)) (since Mar 2021)
- **Member**, Inclusion, Diversity, and Equity in European Astronomy ([IDEEA](#)) (since Feb 2021)
- **Member**, International Research Network for Nuclear Astrophysics ([IReNA](#)) (since Feb 2020)
- **Member**, Joint Institute for Nuclear Astrophysics ([JINA – CEE](#)) (since Feb 2019)
- **Member**, Square Kilometre Array ([SKA](#)) Pulsar Working Group (since Jan 2018)
- **Member**, [PHAROS](#) (European COST Action CA16214) (since Nov 2017)
- **Referee**, A&A, APSS, MNRAS, PRL, grant proposals (since May 2017)
- **Member**, Institute of Physics ([IoP](#)) (since Oct 2014)
- **Member**, German Physical Society ([DPG](#)) (since Jan 2010)
- **SOC**, [Annual PHAROS Conference](#), Patras, Greece (Mar 2020)
- **Convener**, [30th Texas Symposium on Relativistic Astrophysics](#), Portsmouth, UK (Dec 2019)
- **Member**, Le Centre de recherche en astrophysique du Québec ([CRAQ](#)) (Oct 2016 – Dec 2019)
- **Member**, [NewCompStar](#) (European COST Action MP1304) (Nov 2013 – Nov 2017)

DEPARTMENTAL SERVICES

- **Chair**, Pizza Seminars, Institute of Space Sciences (ICE-CSIC) (since Oct 2020)
- **Member**, Equity Committee, Institute of Space Sciences (ICE-CSIC) (since Sept 2020)
- **Organiser**, Machine Learning Journal Club, Institute of Space Sciences (ICE-CSIC) (since July 2020)
- **Co-organiser**, (online) Summer School on AI, Institute of Space Sciences (ICE-CSIC) (July 2021)
- **Member**, AstroMcGill (McGill Space Institute Outreach Team) (Oct 2016 – Dec 2019)
- **Co-organiser**, McGill Space Institute Student Workshops, McGill University (May – Aug 2019)
- **Co-organiser**, McGill Space Institute Seminars, McGill University (June 2017 – May 2019)

DEPARTMENTAL SERVICES (CONTINUED)

- **Organiser**, Postdoctoral Personal Development Workshops, McGill University (Aug – Dec 2018)
- **Co-organiser**, McGill Space Institute Student Workshops, McGill University (May – Aug 2018)
- **Organiser**, Applied Maths Postgraduate Seminar, University of Southampton (Oct 2014 – Aug 2016)

OUTREACH

- Virtual secondary school talk on *Being a Theoretical Astrophysicist* for the [100tífiques](#) initiative on the International Day of Girls and Women in Science, Barcelona, Spain (Feb 2021) (online)
- Webinar on *Neutron Stars – The Strongest Magnets in the Universe* as part of NASA's [Universe of Learning](#) program, USA (October 2020) (online)
- Public lecture on *Wenn Neutronensterne Schluckauf haben* (in German) as part of the [Faszination Astronomie Online](#) series, Haus der Astronomie, Heidelberg, Germany (July 2020) (online)
- Public lecture on *Neutron Stars – Extraordinary Cosmic Laboratories* for SEDS Celestia (Astronomy & Astrophysics Club, BITS Pilani - K. K. Birla Goa Campus), Goa, India (July 2020) (online)
- Public lecture on *Neutron Stars – Extraordinary Cosmic Laboratories* as part of the [Public AstroNight](#) series, AstroMcGill, Montréal, Canada (Dec 2018)
- Science Storytelling Slam hosted by the [Broad Science](#) Initiative, Montréal, Canada (Nov 2018)
- Mentor and judge at the 3rd Annual McGill Physics Hackathon, Montréal, Canada (Nov 2018)
- Secondary school talk on *Our Solar System*, Schillerschule, Tuttlingen, Germany (Oct 2018)
- [Astronomy on Tap](#) talk on *Neutron Stars – A Space Odyssey*, Montréal, Canada (Sept 2017)
- Solar eclipse viewing for thousands of spectators, McGill University, Montréal, Canada (Aug 2017)
- Southampton Science and Engineering Festival, University of Southampton, UK (Mar 2016)
- Einstein's Legacy (outreach event for college students), QMUL, UK (Nov 2015)
- Southampton Science and Engineering Day, University of Southampton, UK (Mar 2015)
- The Big Bang Fair (science fair for secondary school students), Birmingham, UK (Mar 2014)
- Southampton Science and Engineering Day, University of Southampton UK (Mar 2013)

ADDITIONAL WRITING

- **Blog post**, 'A Truly Unique Experience' – Review of #LINO19, Lindau Nobel Laureate Meetings (Sept 2019) <https://www.lindau-nobel.org/blog-review-of-lino19-by-vanessa-graber/>
- **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/>

ADDITIONAL TRAINING

Teaching Techniques for Instructors Workshop, McGill University, Montréal, Canada (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, Germany (Apr – Sept 2009)

- *Details*: Initiative sponsored by the [Baden-Württemberg 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

REFERENCES

- Dr. Nanda Rea, Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona, rea@ice.csic.es
- Prof. Andrew Cumming, McGill University, Montréal, andrew.cumming@mcgill.ca
- Prof. Nils Andersson, University of Southampton, N.A.Andersson@soton.ac.uk
- Prof. Daryl Haggard, McGill University, Montréal, daryl.haggard@mcgill.ca
- Prof. Vicky Kaspi, McGill University, Montréal, vkaspi@physics.mcgill.ca
- Prof. Kostas Kokkotas, Eberhard Karls University, Tübingen, kostas.kokkotas@uni-tuebingen.de