

Research profile

I am a theoretical physicist with over eight years of research experience spanning high-energy physics and general relativity. My work focuses on the analytical description of gravitational binary systems and their waveforms, combining particle-physics tools – such as scattering amplitudes – with post-Newtonian and gravitational self-force methods. During my PhD, I developed a direct link between on-shell scattering amplitudes and gravitational waveforms. Since then, I have developed methods for translating results between scattering and bound Kerr orbits, including their gravitational waveforms, as well as a new effective field theory formulation of gravitational self-force for bound orbits. Overall, my research has involved international collaborations with more than thirty researchers across Europe, North America and Asia.

In 2026, I was awarded the prestigious [Royal Society University Research Fellowship](#), an eight-year fellowship with a total programme value of £1.8 million, for the project *High-precision effective field theory for extreme-mass-ratio inspirals*. My long-term vision is to build a unified framework that connects weak-field Post-Minkowskian and post-Newtonian theory with strong-field methods from the self-force approach, leading to improved waveform models for current (LIGO–Virgo–KAGRA) and future (LISA, ET and CE) gravitational-wave detectors.

Academic appointments

2026– **Royal Society University Research Fellow**, *University of Southampton*, Southampton

2025–2026 **Postdoctoral Research Associate**, *Queen Mary University of London*, London

2022–2025 **Postdoctoral Research Associate**, *University of Edinburgh*, Edinburgh

Fellowships and research funding

More than £2 million in competitive fellowship and programme funding secured to date:

2026 Royal Society University Research Fellowship. Major eight-year fellowship; total programme value approximately £1.8 million. Host: University of Southampton. Project: *High-precision effective field theory for extreme-mass-ratio inspirals*. [\[scheme\]](#)

2019 Marie Skłodowska-Curie ITN fellowship, SAGEX. European Union Horizon 2020 fellowship, providing approximately £100k of personal fellowship support and advanced research and professional training over three years. [\[SAGEX\]](#)

2023–2026 £140k in competitive funding for international programmes and workshops: GGI six-week programme (£83.7k); ICTP-SAIFR two-week programme (£25k); Nordita two-week programme (£20.6k) and Higgs Centre workshop (£10.4k). I was main coordinator of the GGI and Nordita programmes and the Higgs Centre workshop, and co-organiser of the ICTP-SAIFR programme.

Education

2018–2022 PhD in Theoretical Particle Physics, *Trinity College Dublin*, Dublin

Supervisor: R. Britto. Title: *Coherent states and classical radiative observables in the S-matrix formalism* [\[link\]](#). During my PhD, I won a prestigious and competitive Marie-Curie ITN fellowship, *Scattering Amplitudes: from Geometry to Experiments* (SAGEX). The fellowship gave me research training through dedicated workshops and schools and a three-month internship at Wolfram Research, as well as training in scientific writing, presentation skills, STEM outreach, grant writing, time and project management, career development and good scientific practice. A detailed record of these activities is available on the [SAGEX website](#).

2015–2017 MSc in Theoretical Physics, *University of Padova*, Padova, *110/110 cum laude*

Erasmus+ exchange at the University of Göttingen for the MSc thesis *The infinite-spin representations of the Poincaré group*. Final GPA: 29.5/30 (with 5 exams 34 ECTS beyond the degree requirements).

2012–2015 BSc in Physics, *University of Padova*, Padova, *110/110 cum laude*

Final GPA: 29.6/30 (with 1 exam 6 ECTS beyond the degree requirements).

Publications and research impact

My full publication list is available through my [INSPIRE–HEP profile](#) and [ORCID record](#). I have 22 papers, including 20 published in renowned journals such as *Journal of High Energy Physics*, *Physical Review D* and *Physical Review Letters*, with over 1100 citations and an h -index of 16 according to INSPIRE–HEP (July 2026).

Preprints

- [1] **R. Gonzo** and G. Mogull. “Canonical Quantisation of Bound and Unbound WQFT”. Preprint, 2026 [[arXiv:2603.05237](#)].
- [2] F. Alessio, V. Del Duca, **R. Gonzo**, and E. Rosi. “Gravitational amplitudes in the Regge limit: waveforms, shock waves and unitarity cuts”. Preprint, 2026 [[arXiv:2601.21687](#)].

Peer-reviewed publications

- [1] L. Barack, **R. Gonzo**, B. Leather, O. Long, and N. Warburton. “Resummed energy loss in extreme-mass-ratio scattering using critical orbits”. *Phys. Rev. D* 113, 104042 (2026) [[DOI](#)] [[arXiv:2602.10089](#)].
- [2] F. Alessio, V. Del Duca, **R. Gonzo**, E. Rosi, I. Z. Rothstein, and M. Saavedra. “Analytic structure of the high-energy gravitational amplitude: Multi-H diagrams and classical 5PM logarithms”. *Phys. Rev. D* 113, 105013 (2026) [[DOI](#)] [[arXiv:2511.11457](#)].
- [3] D. Akpinar, G. R. Brown, **R. Gonzo**, and M. Zeng. “Unexpected Symmetries of Kerr Black Hole Scattering”. *Phys. Rev. D* 113, L101501 (2026) [[DOI](#)] [[arXiv:2508.10761](#)].
- [4] F. Alessio, **R. Gonzo**, and C. Shi. “Dirac brackets for classical radiative observables”. *Phys. Rev. D* 112, 104060 (2025) [[DOI](#)] [[arXiv:2506.03249](#)].
- [5] D. Akpinar, V. del Duca, and **R. Gonzo**. “The spinning self-force EFT: 1SF waveform recursion relation and Compton scattering”. *Phys. Rev. D* 112, 084014 (2025). **Editor’s Suggestion** [[DOI](#)] [[arXiv:2504.02025](#)].
- [6] **R. Gonzo**, J. Lewis, and A. Pound. “First Law of Binary Black Hole Scattering”. *Phys. Rev. Lett.* 135, 131401 (2025). **Editor’s Suggestion; PRL Collection of the Year 2025** [[DOI](#)] [[arXiv:2409.03437](#)].
- [7] **R. Gonzo** and C. Shi. “Scattering and Bound Observables for Spinning Particles in Kerr Spacetime with Generic Spin Orientations”. *Phys. Rev. Lett.* 133, 221401 (2024) [[DOI](#)] [[arXiv:2405.09687](#)].
- [8] T. Adamo, **R. Gonzo**, and A. Ilderton. “Gravitational bound waveforms from amplitudes”. *JHEP* 05, 034 (2024) [[DOI](#)] [[arXiv:2402.00124](#)].
- [9] S. De Angelis, P. P. Novichkov, and **R. Gonzo**. “Spinning waveforms from the Kosower-Maybee-O’Connell formalism at leading order”. *Phys. Rev. D* 110, L041502 (2024) [[DOI](#)] [[arXiv:2309.17429](#)].
- [10] A. Cristofoli, **R. Gonzo**, N. Moynihan, D. O’Connell, A. Ross, M. Sergola, and C. D. White. “The uncertainty principle and classical amplitudes”. *JHEP* 06, 181 (2024) [[DOI](#)] [[arXiv:2112.07556](#)].
- [11] **R. Gonzo** and A. Ilderton. “Wave scattering event shapes at high energies”. *JHEP* 10, 108 (2023) [[DOI](#)] [[arXiv:2305.17166](#)].
- [12] **R. Gonzo** and C. Shi. “Boundary to bound dictionary for generic Kerr orbits”. *Phys. Rev. D* 108, 084065 (2023) [[DOI](#)] [[arXiv:2304.06066](#)].
- [13] T. Adamo and **R. Gonzo**. “Bethe-Salpeter equation for classical gravitational bound states”. *JHEP* 05, 088 (2023) [[DOI](#)] [[arXiv:2212.13269](#)].
- [14] **R. Gonzo**, T. McLoughlin, and A. Puhm. “Celestial holography on Kerr-Schild backgrounds”. *JHEP* 10, 073 (2022) [[DOI](#)] [[arXiv:2207.13719](#)].
- [15] R. Britto, **R. Gonzo**, and G. R. Jehu. “Graviton particle statistics and coherent states from classical scattering amplitudes”. *JHEP* 03, 214 (2022) [[DOI](#)] [[arXiv:2112.07036](#)].
- [16] A. Cristofoli, **R. Gonzo**, D. A. Kosower, and D. O’Connell. “Waveforms from amplitudes”. *Phys. Rev. D* 106, 056007 (2022). **Editor’s Suggestion** [[DOI](#)] [[arXiv:2107.10193](#)].
- [17] **R. Gonzo** and C. Shi. “Geodesics from classical double copy”. *Phys. Rev. D* 104, 105012 (2021) [[DOI](#)] [[arXiv:2109.01072](#)].
- [18] **R. Gonzo** and A. Pokraka. “Light-ray operators, detectors and gravitational event shapes”. *JHEP* 05, 015 (2021) [[DOI](#)] [[arXiv:2012.01406](#)].
- [19] **R. Gonzo**, T. Mc Loughlin, D. Medrano, and A. Spiering. “Asymptotic charges and coherent states in QCD”. *Phys. Rev. D* 104, 025019 (2021) [[DOI](#)] [[arXiv:1906.11763](#)].
- [20] S. Banerjee, S. Ghosh, and **R. Gonzo**. “BMS symmetry of celestial OPE”. *JHEP* 04, 130 (2020) [[DOI](#)] [[arXiv:2002.00975](#)].

International programmes and workshop series

In parallel with my research, I started a series of meetings to connect the general-relativity and particle physics approaches to binary dynamics, which had often developed separately. The first workshop in Edinburgh focused on scattering amplitudes and self-force; the later meetings covered a wider range of approaches including post-Newtonian, effective-one-body, numerical-relativity and data-analysis methods. The goal has been to develop a common language across these communities, compare methods, identify priorities for waveform modelling and start new collaborations in preparation for future gravitational-wave detectors. I secured competitive funding for the series and was main coordinator for the Edinburgh and Nordita meetings and the upcoming GGI programme.

2027 GGI programme main coordinator and organiser *Synergies for Black-Hole Binaries: from Perturbative Techniques to Strong-Field Gravity*, Florence. Major international six-week programme, with five focused weeks and one conference week.

2027 ICTP-SAIFR programme organiser, forthcoming ICTP-SAIFR / Principia programme *All Roads Lead to Waveforms: GSF, PM, PN and All That*, São Paulo. Two-week programme including a PhD school and a workshop.

2026 Nordita programme main coordinator and organiser, *Amplitudes, Strong-Field Gravity, and Resummation*, Stockholm. Two-week programme including a one week PhD school and a one week workshop, with about 120 participants. [\[programme\]](#)

2025 Workshop organiser, *2nd Annual Workshop on Self-Force and Amplitudes*, University of Southampton. One week workshop with about 70 participants. [\[workshop\]](#)

2024 Higgs Centre workshop main coordinator and organiser, *Gravitational Self-Force and Scattering Amplitudes*, Edinburgh. One week workshop with about 40 participants. [\[workshop\]](#)

Other scientific organisation

2025–2026 Local journal club organiser, QMUL Centre for Theoretical Physics with regular biweekly meetings.

2022–2023 GRAMPA online seminar series organiser, with biweekly meetings on scattering amplitudes and their applications to gravitational waves.

2021 SAGEX Amplitudes School organiser, Niels Bohr Institute, held in connection with the Amplitudes 2021 conference. I helped coordinate the lecturers and the school programme. [\[school\]](#)

Supervision and mentoring

2024– PhD co-supervisor: Emanuele Rosi, Sapienza University of Rome

Co-supervision with Prof. V. Del Duca. I proposed the initial project on ultra-relativistic scattering in gravity using scattering amplitudes. We meet weekly, and the collaboration has already led to two joint papers: [\[arXiv:2511.11457\]](#) and [\[arXiv:2601.21687\]](#).

2024 MSc co-supervisor: Andrea de Simone, Sapienza University of Rome

Six-month thesis on gravitational scattering amplitudes and the two-body problem; co-supervision with Prof. V. Del Duca.

2024 MSc co-supervisor: Damiano Barcaro, Sapienza University of Rome

Six-month thesis: *Scattering waveforms for Kerr black holes from the soft expansion* [\[paper\]](#); subsequently began a PhD at Johannes Gutenberg University Mainz.

2022 MSc supervisor: Leixi Wang, University of Edinburgh

Four-month thesis, *Classical spacetimes from amplitudes*; I proposed the project and supervised it to the end.

Selected invited presentations

I have given more than 20 invited conference and workshop talks and more than 25 invited seminars. Ten of each are listed below; the complete record, including four invited discussion sessions, is available in the full CV.

Conferences and workshops

May 2026 CERN: Gravitational Waves from Amplitudes: Gravitational scattering in the ultra-relativistic limit, Geneva.

Mar. 2026 Max Planck Group Leader Symposium: Particle theory for gravitational waveform modelling, Harnack Haus, Berlin.

- June 2025 **Amplitudes 2025**: *Dirac brackets for classical black-hole scattering: from amplitudes to observables*, Seoul. [\[video\]](#)
- Jan. 2025 **KITP: What Is Particle Theory?**: *Classical bound observables from the S-matrix formalism*, Santa Barbara. [\[video\]](#)
- Oct. 2024 **MIAPbP: EFT and Multi-Loop Methods for Advancing Precision in Collider and Gravitational-Wave Physics**: *On-shell maps between scattering and bound observables*, Munich.
- Sept. 2024 **AEI: Fundamental Physics Meets Waveforms with LISA**: *Black holes as point particles: from amplitudes to bound waveforms*, Potsdam.
- Jan. 2024 **GRAMPA workshop (ICMS)**: *Classical gravitational bound states with amplitudes*, Edinburgh. [\[video\]](#)
- Aug. 2023 **GWs Meet Amplitudes**: *From classical scattering amplitudes to bound-state observables*, São Paulo. [\[video\]](#)
- Dec. 2022 **QCD Meets Gravity**: *Bethe–Salpeter equation for classical gravitational bound states*, Zürich. [\[video\]](#)
- May 2021 **GGI: Gravitational Scattering, Inspiral, and Radiation**: *Waveforms from the KMOC formalism and coherent states*, Florence. [\[video\]](#)

Invited seminars

- June 2026 **CERN**: *High-energy scattering in gravity: Regge theory, shock waves and beyond*, Geneva.
- Dec. 2025 **IHES**: *Regge theory for gravity amplitudes*, Paris.
- June 2025 **AEI**: *Dirac brackets for classical black-hole scattering*, Berlin.
- Feb. 2025 **UCLA**: *Insights into the scattering-to-bound map from the self-force approach*
- Nov. 2024 **NBI**: *The on-shell space of scattering and bound classical observables*, Copenhagen.
- Apr. 2024 **Higgs Centre**: *Scattering and bound observables for spinning particles in Kerr*, Edinburgh.
- May 2023 **IPhT**: *Boundary-to-bound dictionary for generic Kerr orbits*, Paris.
- Nov. 2023 **STAG Centre**: *Spinning waveforms from classical amplitudes*, Southampton.
- Sept. 2021 **Caltech**: *Gravitational event shapes and coherent states for gravitational waves*
- Feb. 2021 **NBI**: *Waveforms from amplitudes and coherent states*, Copenhagen.

Teaching activities

Teaching and tutoring at high-school, Master's and PhD levels, primarily in English:

- 2025 **Invited Lecturer**, PhD school *Analytic Computing in High-Energy and Gravitational Theoretical Physics*, Atrani. Delivered a series of PhD-level lectures entitled *On-shell observables in the gravitational two-body problem* to about 40 graduate students and early-career researchers. [\[school\]](#)
- 2022 **Tutor**, BUSSTEPP, Imperial College London. Two-week PhD-level summer school; tutorial and problem-solving sessions for about 80 international PhD students.
- 2022 **Tutor**, Conformal Bootstrap course, Higgs Centre School of Theoretical Physics. One-week PhD-level school course; tutorial and problem-solving sessions for about 50 international students.
- 2022 **Full-time high-school teacher**, Differential Calculus, International School of Business (Niels Brock programme), Dublin. Three-month course for two high-school classes of about 40 students each; responsible for course delivery, regular assessment, final examination and grading.
- 2019–2020 **Teaching Assistant**, Trinity College Dublin. Master's-level courses in Quantum Field Theory II, Combinatorics and Algebraic Geometry (5 ECTS each); each course lasted about four months, with classes of about 30–40 master students.

Academic service

- 2022– Journal referee for *Journal of High Energy Physics*, *Physical Review D*, *Physical Review Letters*, *Journal of Cosmology and Astroparticle Physics* and *SciPost Physics*.
- 2025 Member of a PhD selection committee at Queen Mary University of London.
- 2024 Panel member for MPhys thesis presentations in Astronomy and Cosmology at the University of Edinburgh; assessed about 50 candidates.

Scientific memberships

- 2025– Core member of the Laser Interferometer Space Antenna (LISA) Consortium; initiating projects on EMRI waveform construction and validation, and on applications of particle physics methods to the modelling of black hole binaries.
- 2026– Core member of the Einstein Telescope (ET) Collaboration.

Research stays

- 2024 Humboldt University, Berlin (September–October); invited by Jan Plefka.
- 2021 Institut de Physique Théorique (IPhT), Paris (November–December); invited by David A. Kosower.
- 2020 Higgs Centre for Theoretical Physics, Edinburgh (February); invited by Donal O'Connell.
- 2019 CERN, Geneva (August); invited by Claude Duhr.

Press and outreach

- 2026 Featured in the Nordita article *Bringing together communities to improve precision in gravitational-wave modeling*, about the scientific aims of the programme and the experience of students and postdoctoral researchers who took part. [\[article\]](#)
- 2022 Interviewed by Charlie Wood for the *Quanta Magazine* article *Massive Black Holes Shown to Act Like Quantum Particles*, about my work on coherent graviton states and the quantum-to-classical transition in black-hole scattering. [\[article\]](#)
- 2022 Contributed personal video footage to the SAGEX film *Doing a PhD in Physics*, presenting the daily life, challenges and rewards of doctoral research. [\[film\]](#)
- 2021 Contributed to the Feynman-diagram section of the exhibition *At the Frontiers of Physics*, using short videos and interactive material to introduce particle physics to a broad audience. [\[exhibition\]](#)
- Public-engagement activities with *Pint of Science* in Padova, Edinburgh and London.

Research software and external collaboration

- 2021 **Mathematics in Industry Study Group**, *ESGI 165 / Defence Science and Technology Laboratory*
Contributed to the report *Using the Electromagnetic Spectrum*. The project focused on estimating the location and power of an unknown transmitter from signal-strength measurements, using mathematical modelling, statistical inference and numerical methods. [\[report\]](#)
- 2021 **Research Software Intern**, *Wolfram Research*, Champaign, Illinois
Developed code for the symbolic integration of products of Meijer G functions with Devendra Kapadia. The implementation outperformed the standard `Integrate` function in a number of cases and was incorporated into Mathematica 14.0.

Technical skills and languages

Skills Mathematica, C++, $\text{\LaTeX}$, Git and Linux; experience with MATLAB and COMSOL Multiphysics.

Languages Italian (mother tongue); English (fluent professional working language).

References

Prof. Ruth Britto, Professor in Theoretical Physics, Trinity College Dublin. britto@maths.tcd.ie

Prof. Donal O'Connell, Professor of Theoretical Physics, University of Edinburgh. donal@ed.ac.uk

Prof. Adam Pound, Professor of Theoretical Physics, University of Southampton. A.Pound@soton.ac.uk

Additional references available upon request: Prof. Tim Adamo, Prof. Leor Barack, Prof. Vittorio Del Duca, Prof. David A. Kosower, Prof. Ira Z. Rothstein, Prof. Niels Warburton and Prof. Mao Zeng.