Riccardo Gonzo

Curriculum Vitae

Summary

I am a theoretical physicist with over seven years of research experience spanning high-energy physics and general relativity. My current work focuses on the analytical description of gravitational binary systems and the modelling of their waveforms by combining modern particle physics tools – such as scattering amplitudes –with traditional general relativity methods like the self-force expansion.

My long-term vision is to create 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) gravitational wave detectors, and to build an international research group at the interface of amplitudes, gravity, and gravitational-wave science.

Academic appointments

2025–	**Postdoctoral research associate**, *Queen Mary University of London*, London.
2022–2025	**Postdoctoral research associate**, *University of Edinburgh*, Edinburgh.

Education

2018–2022 **PhD in theoretical particle physics**, *Trinity College Dublin*, Dublin.

I completed my graduate studies in Trinity College Dublin (Ireland), with a PhD thesis on scattering amplitudes supervised by Ruth Britto. During my PhD, I won a prestigious and competitive Marie-Curie International Training Network (ITN) fellowship about "Scattering Amplitudes: from Geometry to Experiments" (SAGEX). Such fellowship allowed me to learn several sets of skills that have been invaluable in my career, from research ones (through dedicated workshop and schools, and a 3-month internship at Wolfram Mathematica) to soft-skill ones (on scientific writing, time and project management and good scientific practice). A detailed summary of these activities is provided on the main SAGEX website.

2015–2017 **Master of Physics**, *University of Padova*, Padova, *110/110 cum laude*.

+5 extra exams (not required, 34 ECTS credits more) in the study plan/learning agreement

2012–2015 **Bachelor of Physics**, *University of Padova*, Padova, *110/110 cum laude*.

+1 extra exams (not required, 6 ECTS credits more) in the study plan/learning agreement

PhD Thesis

Title	*Coherent states and classical radiative observables in the S-matrix formalism* (Link)
Supervisors	Prof. Ruth Britto

Articles

My full list of publications is available at Riccardo Gonzo INSPIRE HEP profile (🟢). I have 19 papers (17 published in renowned journals such as *Journal of High Energy Physics*, *Physical Review D*, and *Physical Review Letters*), with a total of over 850 citations according to INSPIRE-HEP and an h-index of 14.

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Publication list

[1] 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". In: (Nov. 2025). arXiv: 2511.11457 [hep-th].

[2] D. Akpinar, G. R. Brown, R. Gonzo, and M. Zeng. "Unexpected Symmetries of Kerr Black Hole Scattering". In: (Aug. 2025). arXiv: 2508.10761 [hep-th].

[3] F. Alessio, R. Gonzo, and C. Shi. "Dirac brackets for classical radiative observables". In: *Phys. Rev. D* 112.10 (2025), p. 104060. DOI: 10.1103/ykgq-jqd5. arXiv: 2506.03249 [hep-th].

[4] D. Akpinar, V. del Duca, and R. Gonzo. "The spinning self-force EFT: 1SF waveform recursion relation and Compton scattering". In: *Phys. Rev. D* 112.28 (2025). Editor's Suggestion, p. 084014. DOI: 10.1103/fs74-84v6. arXiv: 2504.02025 [hep-th].

[5] R. Gonzo, J. Lewis, and A. Pound. "First Law of Binary Black Hole Scattering". In: *Phys. Rev. Lett.* 135.13 (2025). Editor's Suggestion, p. 131401. DOI: 10.1103/s85p-gh7b. arXiv: 2409.03437 [gr-qc].

[6] R. Gonzo and C. Shi. "Scattering and Bound Observables for Spinning Particles in Kerr Spacetime with Generic Spin Orientations". In: *Phys. Rev. Lett.* 133.22 (2024), p. 221401. DOI: 10.1103/PhysRevLett.133.221401. arXiv: 2405.09687 [hep-th].

[7] T. Adamo, R. Gonzo, and A. Ilderton. "Gravitational bound waveforms from amplitudes". In: *JHEP* 05 (2024), p. 034. DOI: 10.1007/JHEP05(2024)034. arXiv: 2402.00124 [hep-th].

[8] S. De Angelis, P. P. Novichkov, and R. Gonzo. "Spinning waveforms from the Kosower-Maybee-O'Connell formalism at leading order". In: *Phys. Rev. D* 110.4 (2024), p. L041502. DOI: 10.1103/PhysRevD.110.L041502. arXiv: 2309.17429 [hep-th].

[9] R. Gonzo and A. Ilderton. "Wave scattering event shapes at high energies". In: *JHEP* 10 (2023), p. 108. DOI: 10.1007/JHEP10(2023)108. arXiv: 2305.17166 [hep-th].

[10] R. Gonzo and C. Shi. "Boundary to bound dictionary for generic Kerr orbits". In: *Phys. Rev. D* 108.8 (2023), p. 084065. DOI: 10.1103/PhysRevD.108.084065. arXiv: 2304.06066 [hep-th].

[11] T. Adamo and R. Gonzo. "Bethe-Salpeter equation for classical gravitational bound states". In: *JHEP* 05 (2023), p. 088. DOI: 10.1007/JHEP05(2023)088. arXiv: 2212.13269 [hep-th].

[12] R. Gonzo, T. McLoughlin, and A. Puhm. "Celestial holography on Kerr-Schild backgrounds". In: *JHEP* 10 (2022), p. 073. DOI: 10.1007/JHEP10(2022)073. arXiv: 2207.13719 [hep-th].

[13] R. Britto, R. Gonzo, and G. R. Jehu. "Graviton particle statistics and coherent states from classical scattering amplitudes". In: *JHEP* 03 (2022), p. 214. DOI: 10.1007/JHEP03(2022)214. arXiv: 2112.07036 [hep-th].

[14] A. Cristofoli, R. Gonzo, N. Moynihan, D. O'Connell, A. Ross, M. Sergola, and C. D. White. "The uncertainty principle and classical amplitudes". In: *JHEP* 06 (2024), p. 181. DOI: 10.1007/JHEP06(2024)181. arXiv: 2112.07556 [hep-th].

[15] R. Gonzo and C. Shi. "Geodesics from classical double copy". In: *Phys. Rev. D* 104.10 (2021), p. 105012. DOI: 10.1103/PhysRevD.104.105012. arXiv: 2109.01072 [hep-th].

[16] A. Cristofoli, R. Gonzo, D. A. Kosower, and D. O'Connell. "Waveforms from amplitudes". In: *Phys. Rev. D* 106.5 (2022). Editor's Suggestion, p. 056007. DOI: 10.1103/PhysRevD.106.056007. arXiv: 2107.10193 [hep-th].

[17] R. Gonzo and A. Pokraka. "Light-ray operators, detectors and gravitational event shapes".

In: *JHEP* 05 (2021), p. 015. DOI: 10.1007/JHEP05(2021)015. arXiv: 2012.01406 [hep-th].

[18] S. Banerjee, S. Ghosh, and R. Gonzo. "BMS symmetry of celestial OPE". In: *JHEP* 04 (2020), p. 130. DOI: 10.1007/JHEP04(2020)130. arXiv: 2002.00975 [hep-th].

[19] R. Gonzo, T. Mc Loughlin, D. Medrano, and A. Spiering. "Asymptotic charges and coherent states in QCD". In: *Phys. Rev. D* 104.2 (2021), p. 025019. DOI: 10.1103/PhysRevD.104.025019. arXiv: 1906.11763 [hep-th].

Experience

I have delivered over 20 invited conference and workshop talks, led 4 discussion sessions and given 25 invited seminars across Europe, North America and Asia. These include major international conferences such as Capra and Amplitudes, and invited presentations at leading research centres including KITP, MIAPbP, AEI, UCLA and NBI. In parallel, I started the initiative to bring together the self-force and amplitudes communities, securing competitive funding to create the new *Gravitational Self-Force and Scattering Amplitudes* workshop series. The first event was held in Edinburgh in 2024 and will continue with editions in Southampton (2025) and at Nordita in Stockholm (2026). In addition, I have organized other international workshops and schools, supervised three MSc students and one PhD student, taught at PhD summer schools, and regularly serve as a referee for JHEP, PRD, PRL, JCAP, and SciPost Physics.

Invited talks (conferences, workshops)

2025-11-06 **"Unexpected symmetries and on-shell integrability of Kerr black hole scattering" (FPUK meeting 2025, King's College London)**, London, (Link video).

2025-06-17 **"Dirac brackets for classical black hole scattering: from amplitudes to observables" (Amplitudes 2025)**, Seoul (South Korea), (Link video).

2025-05-08 **"Worldline approach for Kerr black holes: PM vs GSF" (Investigating Compact Objects and Binary Mergers with Gravitational Waves)**, Sapienza University (Rome).

2025-02-26 **"Worldline approach for spinning bound binaries " (First quantisation for physics in strong fields)**, Higgs Centre (Edinburgh).

2025-02-18 **"S-matrix tools for bound waveform modelling" (String Theory as a Bridge between Gauge Theory and Quantum Gravity)** , Sapienza (Rome).

2025-01-16 **"Classical bound observables from the S-matrix formalism" (What is particle theory?)**, KITP (Santa Barbara), (Link video).

2024-10-22 **"On-shell maps between scattering and bound observables" (EFT and Multi-Loop Methods for Advancing Precision in Collider and Gravitational Wave Physics)**, MIAPbP (Munich).

2024-09-06 **"Black holes as point particles: from amplitudes to bound waveforms" (Fundamental physics meets waveforms with LISA workshop)**, AEI (Potsdam).

2024-07-16 **"Light-ray operators in gauge and gravity theory: new infrared finite local observables" (ECCF 2024 workshop)**, Mainz.

2024-02-13 **"Black holes as point particles: from amplitudes to self-force" (Workshop JENAS Initiative: Gravitational Wave Probes of Fundamental Physics)**, Rome.

2024-01-23 **"Classical Gravitational Bound States with Amplitudes" (General Relativity from AMPlitudes Alliance (GRAMPA),ICMS)**, Edinburgh, (Link video).

2023-08-22 **"From classical scattering amplitudes to bound state observables" (GWs meet Amplitudes workshop)**, Sao Paulo, (Link video).

2022-12-14 **"Bethe-Salpeter equation for classical gravitational bound states" (QCD meets gravity)**, Zurich, (Link video).

2022-09-14 **Celestial holography on non-trivial backgrounds" (Workshop on celestial amplitudes and flat space holography)**, Corfu, (Link video).

2022-08-31 **"High-energy limit of quantum and classical wave scattering observables" (Physics in Intense Fields, PIF22)**.

2021-12-15 **"An infinity of amplitude relations in classical physics" (QCD meets gravity)**, *UCLA*, (Link video).

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2021-05-17 **"Waveforms from the KMOC formalism and coherent states" (GGI workshop)**, *GGI*, Florence, (Link video).

Contributed talks

2025-07-23 **"Worldline approach to Kerr black hole: PM vs GSF" (Capra conference 2025)**, Southampton.

2025-04-27 **"Worldline approach for Kerr black holes: PM vs GSF" (Britgrav 2025)**, University of Birmingham.

2023-09-27 **"Classical Gravitational Bound States with Amplitudes" (New Frontiers in Theoretical Physics - XXXVII Convegno Nazionale di Fisica Teorica)**, Cortona.

2020-12-21 **"Light-ray operators and detector algebra" (XVI Avogadro Meeting)**.

Discussion session

2025-07-23 **Invitation to the discussion panel "Synergies and hybrid models" (Capra conference 2025)**, Southampton.

2024-06-28 **Invited talk for the discussion session "Gravitational waves and scattering amplitudes" (S-matrix boostrap 2024 workshop)**, Reykjavík,Iceland.

2024-03-22 **Leader of the discussion session "Self-force and amplitudes" (Gravitational self-force and scattering amplitudes workshop)**, Edinburgh.

2022-09-14 **Invited lecture for the discussion session "Connections between gravity, classical observables and scattering amplitudes"(Celestial amplitudes and flat space holography workshop)**, Corfu.

Invited seminars

2025-12-03 **"Regge theory for gravity amplitudes"**, (IHES, Paris).

2025-11-07 **"High-energy gravitational scattering: Regge theory and shock wave formalism"**, (Amplitudes Lounge Seminar, online).

2025-06-25 **"Dirac brackets for classical black hole scattering"**, AEI, Berlin.

2025-02-07 **"Insights into the scattering-to-bound map from the self-force approach"**, UCLA.

2024-11-19 **"The on-shell space of scattering and bound classical observables"**, NBI, Copenhagen.

2024-09-19 **"Shedding light on bound states with the S-matrix"**, Humboldt university (DFG retreat,Berlin).

2024-09-17 **"Classical scattering and bound observables from the worldline approach to the two-body problem"**, (Worldline Seminars series online).

2024-05-17 **"From amplitudes to gravitational bound observables"**, Zurich.

2024-05-07 **"Classical bound observables from amplitudes"**, SNS, Pisa.

2024-04-30 **"Scattering and bound observables for spinning particles in Kerr"**, Higgs Centre, Edinburgh.

2024-04-03 **"Gravitational bound waveforms from amplitudes"**, NTNU, Taiwan (online).

2024-03-13 **"Gravitational bound waveforms from amplitudes"**, ITMP, Moscow State University (online).

2024-02-28 **"Gravitational bound waveforms from amplitudes"**, Joint Belgian HEPTH Seminars, Brussels.

2023-11-22 **"Scattering and bound waveforms for Kerr black holes"**, Sapienza, Rome.

2023-11-20 **"Scattering and bound waveforms for Kerr black holes"**, Tor Vergata, Rome.

2023-11-10 **"Spinning waveforms from classical amplitudes"**, STAG centre, Southampton.

2023-05-04 **"Boundary to bound dictionary for generic Kerr orbits"**, IPhT, Paris.

2023-03-22 **"Shedding light on bound states with amplitudes"**, University of Geneva, Geneva.

2022-12-01 **"Bethe-Salpeter equation for classical bound states"**, *Higgs Centre*, Edinburgh.

2022-11-18 **"Celestial holography on non-trivial backgrounds"**, University of Nottingham.

2022-04-28 **"Amplitudes for the classical two-body problem in general relativity"**, *University of Padova*.

2022-03-21 **"Classical amplitudes for the two-body problem in GR"**, *UCD*, Dublin.

2021-09-29 **"Gravitational event shapes and coherent states for gravitational waves"**, *Caltech*.

2021-06-30 **"Coherent states from amplitudes and classical factorization"**, *Higgs Centre*, Edinburgh.

2021-02-18 **"Waveforms from amplitudes and coherent states"**, *NBI institute*, Copenhagen.

2020-01-30 **"OPE at null infinity"**, *TCD*, Dublin.

2017-05-29 **"The structure of intertwiners in the infinite spin representation"**, Göttingen.

Conference/Workshops/School/Seminar organization

2026 **Organizer of the Nordita program "Amplitudes, Strong-Field Gravity, and Resummation" (Link)**, Nordita Institute, Stockholm.

2025 **Organizer of the "2nd Annual Workshop on Self-Force and Amplitudes" workshop (Link)**, University of Southampton.

2024 **Organizer of the "Gravitational self-force and scattering amplitudes" workshop (Link)**, Higgs Centre, Edinburgh.

2022-2023 **Organizer of the GRAMPA seminar series**, (online).

2021 **Organizer of the SAGEX amplitude school (Link)**, NBI institute, Copenhagen.

Teaching activities

2025 **Lecturer for the PhD school in Atrani on "Analytic Computing in High-Energy and Gravitational Theoretical Physics" (Link)**, Atrani (Italy).

2024 **Panel member for MPhys thesis presentations**, University of Edinburgh.

2022 **Tutor for the PhD school BUSSTEPP 2022 (2 weeks)**, Imperial College, London.

2022 **Tutor for the Conformal Bootstrap course at the Higgs Centre School of Theoretical Physics (1 week)**, Higgs Centre, Edinburgh.

2022 **Math teacher for differential calculus (Niels Brock program,3 months)**, ISB.

2020 **Teaching Assistant of Combinatorics class MAU34107**, TCD.

2019 **Teaching Assistant of Quantum Field theory II class MA4446**, TCD.

2019 **Teaching Assistant of Algebraic Geometry class MA341F**, TCD.

Research stays

9-10/2024 Humboldt university, Berlin (invited by Jan Plefka)

11-12/2021 Institut de Physique Théorique - IPhT (invited by David Kosower)

02/2020 Higgs Centre for Theoretical Physics (invited by Donal O'Connell)

08/2019 CERN (invited by Claude Duhr)

Referee activities

Journals: Journal of High-Energy Physics (JHEP), Physical Review D (PRD), Physical Review Letters (PRL), Journal of Cosmology and Astroparticle Physics (JCAP), SciPost Physics

Supervision

2024- **PhD student, Sapienza (Emanuele Rosi), Cosupervision with V.Del Duca**, *INSPIRE HEP*.

2024 **Msc student, Sapienza (Andrea de Simone), Cosupervision with V.Del Duca**, *Gravitational self-force from scattering amplitudes*.

2024 **Msc student, Sapienza (Damiano Barcaro),Cosupervision with V.Del Duca**, *Scattering waveforms for Kerr black holes from the soft expansion*, ($\rightarrow$ PhD at Mainz University).

2023 **Msc student, Edinburgh (Leixi Wang)**, *Classical spacetimes from amplitudes*.

Awards

2025 16.4 k£ awarded for the organization of the Nordita program "Amplitudes, Strong-Field Gravity, and Resummation" at the Nordita institute, Stockholm (Link to the webpage)

2023 10.4 k£ awarded for the organization of the workshop "Gravitational self-force and amplitudes" at the Higgs Centre of Theoretical Physics, Edinburgh (Link to the webpage)

2019 Marie Skłodowska-Curie grant "SAGEX" from the European Union's Horizon 2020 research and innovation programme (Link to the webpage)

2011 First place, "Riccardo Rossi" scholarship (Link to the webpage)

References

1) Ruth Britto (email: britto@maths.tcd.ie): Professor in Theoretical Physics, School of Mathematics, Trinity College Dublin

2) Donal O'Connell (email: donal@ed.ac.uk): Professor, School of Physics and Astronomy, Univ. of Edinburgh

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3) Adam Pound (email: A.Pound@soton.ac.uk): Professor, School of Mathematical Sciences, Univ. of Southampton

Computer skills

Advanced	C++, LaTeX, MATHEMATICA, INKSCAPE, Linux, Microsoft Office
Intermediate	COMSOL MULTIPHYSICS, MATLAB, GIT, HTML

Languages

Italian	**Mother tongue**	
English	**Professional working language**	*Fluent in conversation*