

2021 CURRICULUM VITAE for Dr RICHARD HOWL

CONTACT DETAILS

QICI Quantum Information and Computation Initiative
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EDUCATION AND ACADEMIC EMPLOYMENT HISTORY

- Post-doctoral research fellow, joint position between the Departments of Computer Science at the University of Hong Kong and the University of Oxford (Sep 2020 -).
- Post-doctoral research fellow, Quantum Correlations Group, School of Mathematical Sciences, University of Nottingham, UK.
- Post-doctoral research fellow, Relativistic Quantum Technologies Group, School of Mathematical Sciences, University of Nottingham, UK.
- Post-doctoral research associate, Relativistic Quantum Information and Metrology Group, Faculty of Physics, University of Vienna, Austria.
- PhD in High-Energy Theoretical Physics, University of Southampton, UK.
- Masters and Bachelors in Physics (MPhys), Jesus College, University of Oxford, UK.

INDUSTRIAL EMPLOYMENT

- Science teacher, Bluecoat Academy, Nottingham, trained through the Researchers in Schools (RIS) programme.
- Software Engineer, D-Cubed Components, Cambridge, Job role: to develop and create analytical and numerical mathematical algorithms for solving multi-dimensional geometrical problems on vector spaces.

PUBLICATIONS (16, with over 330 citations)

- Quantum Frequency Interferometry: with applications ranging from gravitational wave detection to dark matter searches, R Howl, I Fuentes, arXiv:2103.02618.
- Non-Gaussianity as a Signature of a Quantum Theory of Gravity, R Howl, V Vedral, D Naik, M Christodoulou, C Rovelli, A Iyer, PRX Quantum 2, 010325.
- Quantum-enhanced screened dark energy detection, D Hartley, C Käding, R Howl, I Fuentes, arXiv:1909.02272.
- Active Interferometry with Gaussian Channels, R Howl and I Fuentes, arXiv:1902.09883.
- Exploring the unification of quantum theory and general relativity with a Bose-Einstein condensate, R Howl, R Penrose and I Fuentes, New Journal of Physics **21**, 043047.
- Quantum simulation of dark energy candidates, D Hartley, C Käding, R Howl and I Fuentes, Phys. Rev. D **99**, 105002.
- Analogue simulation of gravitational waves in a 3+1-dimensional Bose-Einstein condensate, D. Hartley, T. Bravo, D. Ratzel, R. Howl, and I. Fuentes, Phys. Rev. D **98**, 025011.
- Dynamical response of Bose-Einstein condensates to oscillating gravitational fields, D. Ratzel, R. Howl, J. Lindkvist, and I. Fuentes, New Journal of Physics **20**, 073044.
- Frequency spectrum of an optical resonator in a curved spacetime, D. Ratzel, F. Schneider, D. Braun, T. Bravo, R. Howl, M. P. E. Lock, and I. Fuentes, New Journal of Physics **20**, 053046.
- Quantum decoherence of phonons of Bose-Einstein condensates, R. Howl, C. Sabin, L. Hackermuller, and I. Fuentes, Journal of Physics B: Atomic, Molecular and Optical Physics **51**, 015303.
- Gravity in the quantum lab, R. Howl, L. Hackermuller, D. E. Bruschi, and I. Fuentes, Advances in Physics: X **3**, 1383184.
- Aspects of the Exceptional Supersymmetric Standard Model, P. Anthron, J. P. Hall, R. Howl, S.F. King, D. J. Miller, S. Moretti, R.Nevzorov. Nucl. Phys. Proc. Suppl. 200-202, 120-129.
- Solving the Flavour Problem in Supersymmetric Standard Models with Three Higgs Families.

R. Howl and S.F. King. Phys. Lett. B **687** 355-362.

- Exceptional Supersymmetric Standard Model with non-Abelian Discrete Family Symmetry, R. Howl and S.F. King, JHEP **0805** 008.
- Minimal E(6) Supersymmetric Standard Model, R. Howl and S.F. King, JHEP **0801** 030.
- Planck Scale Unification in a Supersymmetric Standard Model, R. Howl and S.F. King, Phys. Lett. B **652** 331.

TALKS AT INVITED SEMINARS AND CONFERENCES

I have presented 19 talks at conferences, workshops and seminars, including 5 invited talks:

Invited seminar at the Uniwersytet Szczeciński, Poland; Seminar at the University of Hong Kong; Invited talk at QISS workshop, University of Hong Kong; Gravity in the Lab workshop, Benasque, Spain; Invited talk at the International Conference on Quantum Communication, Measurement and Computing (QCMC), Louisiana State University, USA; Invited seminar at the University of York, UK; Eighth International Workshop DICE2016 Spacetime - Matter - Quantum Mechanics at Castiglione, Italy; Workshop “Gravity in the lab”, Benasque, Spain; SFB-FoQus workshop, University of Innsbruck, Austria; Invited talk at EPSRC INSPIRE meeting at the University of Nottingham, UK; UK Neutrino Network Meeting at the University of Southampton, UK; UK BSM8 at the University of Sussex; UK BSM7 at the University of Liverpool, UK; BUSSTEPP at the University of Edinburgh, UK; 3 x seminars at the University of Southampton, UK; Several seminars at D-Cubed components, Cambridge, UK.

TEACHING

- Mini course on Relativistic Quantum Information Theory, University of Hong Kong.
- Quantum Optics II MSc course, University of Vienna.
- Relativistic Quantum Information and Metrology MSc course, University of Vienna.
- Mathematical Physics (demonstrator and marker), University of Nottingham.
- Private mathematics and physics tutoring.
- Training for employees of D-Cubed and industrial customer VTK.

MEDIA COVERAGE

- My publication “Non-Gaussianity as a Signature of Quantum Gravity” received a lot of media attention, with articles in Physics World <https://physicsworld.com/a/quantum-gravity-could-soon-be-tested-using-ultracold-atoms/>, IEEE Spectrum Magazine (TBA), and numerous media outlets such as Phys.org, Science Daily etc., as well as blogs.
- My publication “Exploring the unification of quantum theory and general relativity...” was listed as the most thought-provoking paper of the week in “The Best of the Physics arXiv”, MIT Technology Review.

WRITING AND MODERATING EXAMINATIONS

- Quantum Optics II, University of Vienna, examiner and moderator.
- Theoretical Physics (Special Relativity), University of Vienna, examiner and moderator.

SUPERVISION

Co-supervision and management of two MSc students and two PhD students of the University of Vienna (Kirill Mechtcheriakov, Paul Juschitz, Tupac Bravo and Daniel Hartley), and an MSc, PhD student and summer project student at the University of Nottingham (Michael Tolan, Jan Kohlrus, Jack Hughes).

MANAGEMENT

As part of my role as a post-doctoral researcher at Vienna and Nottingham, I had been expected to

help with the management of the groups, which had consisted of 18 members.

GRANTS

FXQi grant application “Benasque session on Relativistic Quantum Observers” for \$11,260.00. I have also contributed to three ERC collaborative (FET) grants, a European QuantERA grant, and a UKRI collaboration grant.

ORGANISED CONFERENCES, WORKSHOPS and PUBLIC TALKS

I have co-organised the following conferences, workshops and public talks:

- Gravity in the lab workshop 2018, Centro de Ciencias de Benasque Pedro Pascual, Benasque, Spain (invited speakers included: Carlo Rovelli, Francesca Vidotto, Tim Muadlin, Hendrik Ulbricht, Sougato Bose, Daniel Oi and Philippe Bouyer).
- “Can we see black holes?”, public talk with Sir Roger Penrose and Professor Ivette Fuentes, University of Nottingham, 2018.
- Organization of a University of Nottingham course on twistor theory by Sir Roger Penrose.
- The Penrose Institute Inauguration workshop, University of Nottingham, 2018.
- Detecting gravitational waves with phonons of a BEC workshop, University of Vienna, 2016.

OUTREACH

- Physics presentations for 9-11 year olds at Bluecoat academy, Nottingham.
- Organisation of public talk “How can we see black holes?” by R. Penrose and I. Fuentes at the University of Nottingham.
- Demonstrating for A-level students at open day workshops at the University of Southampton.

REFEREEING

Physics Letters A and B, Nature Communications, Nature Scientific Reports.

PROGRAMMING

Mathematica, MATLAB, C++, Python, LaTeX.