

# André Xuereb

*Associate Professor*

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Date and place of birth: 2nd January 1985, Malta

Nationality: Maltese (EU Passport)

**At a glance:** Holder of M.Ent. (2015), Ph.D. (2011), and B.Sc. (2007). Tenured academic. 40+ published peer-reviewed articles. 40+ technical and general public talks. Management of several COST Actions. Organiser of distinguished public lectures. Contributor to Maltese science policy.

**Specialisation:** Physics; quantum mechanics, optomechanics, quantum thermodynamics, quantum optics, laser cooling.

## Employment and Affiliation History

2018–	Associate Professor in the Department of Physics at the University of Malta (backdated to March 2016)
2016–	Science Policy Officer, Malta Chamber of Scientists
2016–2018	Senior Lecturer (equivalent to US Associate Professor) in the Department of Physics at the University of Malta
2014–2016	Lecturer in the Department of Physics at the University of Malta
2011–2016	Visiting Researcher with the QTeQ research group at Queen’s University Belfast
2013–2014	Affiliate Lecturer in the Department of Physics at the University of Malta
2011–2014	1851 Royal Commission Research Fellow
02–10/2011	Postdoctoral researcher with Prof. Klemens Hammerer at the Institute for Theoretical Physics at the Leibniz University in Hanover

## **Management experience**

- Co-owner of an educational software start-up
- Organisation and chairing of conferences, both in Europe and in the United States
- Management Committee member for Malta and Early-Stage Researcher representative for COST Actions MP1209 (Thermodynamics in the Quantum Regime) and MP1403 (Nanoscale Quantum Optics); Dissemination and Outreach representative for MP1209; Management Committee Member for MP1405 (Quantum Structure of Spacetime) and CA16221 (Quantum Technologies with Ultra-Cold Atoms); founding member of CA15220 (Quantum Technologies in Space) and CA17113 (Trapped Ions)
- Management of several final-year BSc project students at the University of Malta
- Led own research programme throughout the three years (Oct. 2011–Oct. 2014) during which Research Fellowship was held

## Education

2013–2015	Master in Knowledge-Based Entrepreneurship (MEnt) at the University of Malta
2007–2011	Doctorate (PhD) in Physics in the Quantum Control group, run by Tim Freegarde, at the University of Southampton, UK. Thesis title: ‘Optical Cooling Using the Dipole Force.’ <i>Viva voce</i> examiners: Prof. J. Dalibard (ENS Paris, external), and Prof. A. C. Tropper (internal)
2003–2007	Bachelor of Science with Honours [BSc (Hons)] in Mathematics & Physics, University of Malta.

Graduated with First Class honours (*summa cum laude*)

1996–2003 Secondary school and Sixth form, St. Aloysius' College, Malta. Graduated with 4 'A' levels (Pure Mathematics [grade A], Mechanics [grade A], Physics [grade A], and Computing [grade B])

## Grants, honours & awards

- 2018 • Maltese PI on the NATO SPS multi-year project "SEQUEL—Secure Quantum Communication Undersea Link" (€90k share)
- Academic partner in a VERTIGO-funded artistic residency with Horizon 2020 FET project HOT
- 2017 • SME partner in Erasmus+ project "CURIO—A Teaching Toolkit for Fostering Scientific Curiosity" (€59k share)
- PI, together with Vittorio Peano, on the Julian Schwinger Foundation project "Topological Optomechanical Metamaterials" (\$90k)
- Member of the Global Young Academy
- Outstanding Referee of the Institute of Physics (New Journal of Physics)
- Outstanding Referee of the American Physical Society
- 2016 • Co-proposer of Light Pushes Stuff, an interactive art-and-science installation co-funded by the Malta Arts Fund (€15k share)
- Maltese PI on the Horizon 2020 FET-PROACT "HOT—Hybrid Optomechanical Technologies" (€562k share)
- 2014 • Distinguished Referee of the European Physics Journal
- 2013 • Attended Falling Walls 2013 on behalf of the University of Malta; presented at Falling Walls Labs
- 2012 • Attended the Lindau Nobel Laureates Meeting 2012, dedicated to Physics, as a Young Researcher on behalf of the University of Malta
- 2012 • PhD thesis published as part of the *Springer Theses* series of books
- 2011–2014 • Research fellowship from the Royal Commission for the Exhibition of 1851
- 2009, 2010 • Best poster in respective years of study at the University of Southampton School of Physics and Astronomy Poster Day
- 2007–2011 • EPSRC-funded studentship for a duration of three-and-a-half years to read for a PhD at the University of Southampton, UK
- 2007 • BOV Prize in Mathematics
- 2007 • Robing during the graduation ceremony at the University of Malta
- 2007 • Member of the first official group of Maltese students to attend the CERN SUMMER SCHOOL
- 2004–2007 • Faculty of Science Dean's List award at the University of Malta in each year of study

## Publications, talks & outreach

### Peer-reviewed journal articles

- Summary** *Science*: 1; *Physical Review Letters*: 5; *Physical Review X*: 1; *New Journal of Physics*: 7  
Total published: 40, of which first author: 19  
Research highlights of *Nature Photonics*: 1; synopses in *Physics*: 1  
Full list of arXiv pre-prints at [http://www.arxiv.org/a/xuereb\\_a\\_1](http://www.arxiv.org/a/xuereb_a_1)
- 2018 • Sofia Qvarfort, Alessio Serafini, André Xuereb, Dennis Rätzel, and David Edward Bruschi; *Enhanced nonlinearity through optomechanical modulation*; arXiv:1812.08874
  - József Zsolt Bernád, Claudio Sanavio, and André Xuereb; *Optimal estimation of matter-field couplings in the dipole approximation*; arXiv:1811.10088
  - Muhammad T. Naseem, André Xuereb, and Özgür E. Müstecaplıoğlu; *Thermodynamic consistency of the optomechanical master equation*; Phys. Rev. A **98**, 052123 (2018); arXiv:1806.08175
  - Cecilia Clivati, Anna Tampellini, Alberto Mura, Filippo Levi, Giuseppe Marra, Pauline Galea, André Xuereb, and Davide Calonico; *Optical frequency transfer over submarine fiber links*; Optica **5**, 893 (2018)
  - David Edward Bruschi, and André Xuereb; *'Mechano-optics': An optomechanical quantum simulator*; New J. Phys. **20**, 065004 (2018); arXiv:1712.02532

- Giuseppe Marra, Cecilia Clivati, Lockett Richard, Anna Tampellini, Jochen Kronjäger, Louise Wright, Alberto Mura, Filippo Levi, Stephen Robinson, André Xuereb, Brian Baptie, and Davide Calonico; *Ultrastable laser interferometry for earthquake detection with terrestrial and submarine cables*; Science **361**, 486 (2018); arXiv:1801.02698
- József Zsolt Bernád, Claudio Sanavio, and André Xuereb; *Optimal estimation of optomechanical coupling strength*; Phys. Rev. A **97**, 063821 (2018) arXiv:1712.09712
- Sören Wengerowsky, Siddarth Koduru Joshi, Fabian Steinlechner, Julien R. Zichi, Sergiy M. Dobrovolskiy, René van der Molen, Johannes W. N. Los, Val Zwiller, Marijn A. M. Versteegh, Alberto Mura, Davide Calonico, Massimo Inguscio, Hannes Hübel, Anton Zeilinger, André Xuereb, and Rupert Ursin; *In-field entanglement distribution over a 96 km-long submarine optical fibre*; arXiv:1803.00583
- Shabir Barzanjeh, Matteo Aquilina, and André Xuereb; *Manipulating the flow of thermal noise in quantum devices*; Phys. Rev. Lett. **120**, 060601 (2018); arXiv:1706.09051
- 2016 • Bhagya Nair, André Xuereb, and Aurélien Dantan; *Cavity optomechanics with arrays of thick dielectric membranes*; Phys. Rev. A **94**, 053812 (2016); arXiv:1608.03704
- Jie Li, André Xuereb, Nicola Malossi, and David Vitali; *Cavity Mode Frequencies and Large Optomechanical Coupling in Two-Membrane Cavity Optomechanics*; J. Opt. **18**, 084001 (2016); arXiv:1512.07536
- Simon Pigeon, and André Xuereb; *Thermodynamics of trajectories of open quantum systems, step by step*; J. Stat. Mech. **6**, 063203 (2016)
- Celso J. Villas-Boas, Wesley B. Cardoso, Ardiley T. Avelar, André Xuereb, Norton G. de Almeida; *Does “cooling by heating” protect quantum correlations?*; Quantum Inf. Process. **15**, 2021 (2016)
- James Millen, and André Xuereb; *Perspective on quantum thermodynamics*; New J. Phys. **18**, 011002 (2016); arXiv:1509.01086
- Simon Pigeon, Lorenzo Fusco, André Xuereb, Gabriele De Chiara, and Mauro Paternostro; *Thermodynamics of trajectories and local fluctuation theorems for harmonic quantum networks*; New J. Phys. **18**, 013009 (2016); arXiv:1510.01905. Highlighted in a *Perspective* article: New J. Phys. **18**, 011001 (2016)
- 2015 • Simon Pigeon, Lorenzo Fusco, André Xuereb, Gabriele De Chiara, and Mauro Paternostro; *Thermodynamics of trajectories of a quantum harmonic oscillator coupled to  $N$  baths*; Phys. Rev. A **92**, 013844 (2015); arXiv:1411.2637
- Matteo Brunelli, André Xuereb, Alessandro Ferraro, Gabriele De Chiara, Nikolai Kiesel, and Mauro Paternostro; *Out-of-equilibrium thermodynamics of quantum optomechanical systems*; New J. Phys. **17**, 035016 (2015); arXiv:1412.4803
- André Xuereb, Alberto Imparato, and Aurélien Dantan; *Heat transport in harmonic oscillator systems with thermal baths: application to optomechanical arrays*; New J. Phys. **17**, 055013 (2015); arXiv:1411.1853
- Simon Pigeon, André Xuereb, Igor Lesanovsky, Juan P. Garrahan, Gabriele De Chiara, and Mauro Paternostro; *Dynamical symmetries and crossovers in a three-spin system with collective dissipation*; New J. Phys. **17**, 015010 (2015); arXiv:1409.0422
- André Xuereb, Hendrik Ulbricht, and Mauro Paternostro; *Macroscopicity in an optomechanical matter-wave interferometer*; Opt. Comm. **337**, 53 (2015); arXiv:1407.5196
- Jiang Zhang, Tiancai Zhang, André Xuereb, David Vitali, and Jie Li; *More nonlocality with less entanglement in a tripartite atom–optomechanical system*; Ann. Phys. **527**, 147 (2015); arXiv:1402.3872
- 2014 • Lorenzo Fusco, Simon Pigeon, Tony J. G. Apollaro, André Xuereb, Laura Mazzola, Michele Campisi, Alessandro Ferraro, Mauro Paternostro, and Gabriele De Chiara; *Assessing the Nonequilibrium Thermodynamics in a Quenched Quantum Many-Body System via Single Projective Measurements*; Phys. Rev. X **4**, 031029 (2014); arXiv:1404.3150
- André Xuereb, Claudiu Genes, Guido Pupillo, Mauro Paternostro, and Aurélien Dantan; *Reconfigurable long-range phonon dynamics in optomechanical arrays*; Phys. Rev. Lett. **112**, 133604 (2014); arXiv:1312.5303
- 2013 • André Xuereb, Hendrik Ulbricht, and Mauro Paternostro; *Optomechanical interface for probing matter-wave coherence*; Sci. Rep. **3**, 3378 (2013); arXiv:1308.3576
- André Xuereb, Claudiu Genes, and Aurélien Dantan; *Collectively-enhanced optomechanical coupling in periodic arrays of scatterers*; Phys. Rev. A **88**, 053803 (2013); arXiv:1304.4574
- Claudiu Genes, André Xuereb, Guido Pupillo, and Aurélien Dantan; *Enhanced optomechanical read-*

- out using optical coalescence; Phys. Rev. A **88**, 033855 (2013); arXiv:1304.1715
- André Xuereb, and Mauro Paternostro; *Selectable linear or quadratic coupling in an optomechanical system*; Phys. Rev. A **87**, 023830 (2013); arXiv:1212.0641
  - Tim Freegarde, James Bateman, André Xuereb, and Peter Horak; *Mirror-mediated cooling: A paradigm for particle cooling via the retarded dipole force*; Annual Review of Cold Atoms and Molecules **1**, 353 (2013); arXiv:0904.3059
  - 2012 • André Xuereb, Claudiu Genes, and Aurélien Dantan; *Strong Coupling and Long-Range Collective Interactions in Optomechanical Arrays*; Phys. Rev. Lett. **109**, 223601 (2012); arXiv:1202.6210
  - André Xuereb, and Peter Domokos; *Dynamical scattering models in optomechanics: going beyond the ‘coupled cavities’ model*; New J. Phys. **14**, 095027 (2012); arXiv:1204.5301
  - André Xuereb, Koji Usami, Andreas Naesby, Eugene S. Polzik, and Klemens Hammerer; *Exciton-mediated photothermal cooling in GaAs membranes*; New J. Phys. **14**, 085024 (2012); arXiv:1205.6726
  - André Xuereb, Marco Barbieri, and Mauro Paternostro; *Multipartite optomechanical entanglement from competing nonlinearities*; Phys. Rev. A **86**, 013809 (2012); arXiv:1204.5870
  - 2011 • André Xuereb, Roman Schnabel, and Klemens Hammerer; *Dissipative Optomechanics in a Michelson–Sagnac Interferometer*; Phys. Rev. Lett. **107**, 213604 (2011); arXiv:1107.4908
  - André Xuereb, Peter Domokos, Peter Horak, and Tim Freegarde; *Cavity cooling of atoms: Within and without a cavity*; Eur. Phys. J. D **65**, 273 (2011); arXiv:1101.2739
  - André Xuereb, Peter Horak, and Tim Freegarde; *Amplified optomechanics in a unidirectional ring cavity*; J. Mod. Opt. **58**, 1342 (2011); arXiv:1101.0130
  - 2010 • André Xuereb, Peter Domokos, Peter Horak, and Tim Freegarde; *Scattering theory of multilevel atoms interacting with arbitrary radiation fields*; Phys. Scr. **T140**, 014010 (2010); arXiv:0910.0802
  - Peter Horak, André Xuereb, and Tim Freegarde; *Optical cooling of atoms in microtraps by time-delayed reflection*; J. Comput. Theor. Nanosci. **7**, 1747 (2010); arXiv:0911.4805
  - James Bateman, Richard Murray, Matthew Himsworth, Hamid Ohadi, André Xuereb, and Tim Freegarde; *Hänsch–Couillaud locking of Mach–Zehnder interferometer for carrier removal from a phase-modulated optical spectrum*; J. Opt. Soc. Am. B **27**, 1530 (2010); arXiv:0911.1695
  - André Xuereb, Tim Freegarde, Peter Horak, and Peter Domokos; *Optomechanical cooling with generalized interferometers*; Phys. Rev. Lett. **105**, 013602 (2010); arXiv:1002.0463
  - James Bateman, André Xuereb, and Tim Freegarde; *Stimulated Raman transitions via multiple atomic levels*; Phys. Rev. A **81**, 043808 (2010); arXiv:0908.2389
  - André Xuereb, Mathias Groth, Karl Krieger, Otto Asunta, Taina Kurki-Suonio, Jari Likonen, David P Coster, and ASDEX Upgrade Team; *DIVIMP-B2-EIRENE modelling of  $^{13}\text{C}$  migration and deposition in ASDEX Upgrade L-mode plasmas*; J. Nucl. Mater. **396**, 2–3, 228 (2010). Based on work done whilst on an IAESTE traineeship at the Helsinki University of Technology (TKK, now Aalto University), July–August 2006
  - 2009 • Hamid Ohadi, Matthew Himsworth, André Xuereb, and Tim Freegarde; *Magneto-optical trapping and background-free imaging for atoms near nanostructured surfaces*; Opt. Express **17**, 25, 23003 (2009); arXiv:0910.5003
  - André Xuereb, Peter Horak, and Tim Freegarde; *Atom cooling using the dipole force of a single retro-reflected laser beam*; Phys. Rev. A **80**, 013836 (2009); arXiv:0903.2945
  - André Xuereb, Peter Domokos, János Asbóth, Peter Horak, and Tim Freegarde; *Scattering theory of heating and cooling in optomechanical systems*; Phys. Rev. A **79**, 053810 (2009); arXiv:0903.3132. Given a synopsis in the APS journal *Physics* and mentioned in the Research Highlights section of Nature Photonics **3**, 7 (2009)

### Conference proceedings

- 2018 • André Xuereb, Matteo Aquilina, and Shabir Barzanjeh; *Routing thermal noise through quantum networks*; Proc. SPIE **10672**, 10672N (2018); arXiv:1806.01000. Presented at SPIE Photonics Europe 2018 (invited contribution)
- 2011 • Peter Domokos, André Xuereb, Peter Horak, and Tim Freegarde; *Efficient optomechanical cooling in one-dimensional interferometers*; Proc. SPIE **7951**, 79510B (2011). Presented at SPIE Photonics West 2011 (invited contribution)

## Books and contributed chapters

- *Optical Cooling using the Dipole Force*, Springer Theses (2012); ISBN 978-3-642-29714-4

## Articles in the popular press

- 2018 • *Accidental science*; Think (the University of Malta research Magazine), October
- 2017 • *Seeing the light*; The Sunday Times of Malta, 29<sup>th</sup> January
- 2016 • *Invest in research, invest in Malta – we deserve it*; The Sunday Times of Malta, 25<sup>th</sup> September
- *Quantum physics, for dummies*; The Times of Malta Sunday Circle, June
- *The rise of the quantum machines*, together with Dr James Millen; Physics World, January
- 2015 • *What can Malta learn from Singapore?*, together with Dr Edward Duca; Think (the University of Malta research Magazine), December
- 2013 • *A light conversation*; Sunday Times of Malta, December 8
- *The Exotic World of the Very Small*; Think (the University of Malta research Magazine), January

## Talks

- 2018 • *Why Malta should become the Quantum Island*; Malta Innovation Summit 2018 (St Julians, October)
- *Routing thermal noise through quantum networks and Fun with telecom fibres*; University of St Andrews (St Andrews, September)
- *Quantum Islands*; IQIS18 Flagship Day (Catania, September)
- *Routing thermal noise through quantum networks*; Instituto Superior Técnico (Lisbon, July)
- *Fun with telecom fibres*; Instituto Superior Técnico (Lisbon, July)
- *Light Pushes Stuff: marrying science, arts and abstraction*, together with Danielle M Farrugia; EUSEA 2018 (Madrid, May)
- [Public] *Weird. Random. Quantum.*; a talk about quantum mechanics given to the general public at Casey's Bar (Malta, May)
- [Invited] *Routing thermal noise through quantum networks*; SPIE Photonics Europe 2018 (Strasbourg, April)
- [Invited] *Big science in small countries: Multinational projects seen from the eyes of Malta*; Science and Society: Challenges and Prospects, a Meeting of the Asian Young Academies in Israel (Jerusalem, February)
- *Optimal estimation of optomechanical coupling*; OMT-HOT 2018 (Saanen, January)
- 2017 • [Public] *Light pushes stuff*; a Malta Café Scientifique talk given together with Vittorio Peano about quantum thermodynamics given to the general public (Malta, December)
- *Manipulating heat flow in quantum devices*; Foundations and Applications of Nanomechanics (Trieste, September)
- [Public] *Weird. Random. Quantum.*; a talk about quantum mechanics given to the general public as part of Science in the Citadel (Gozo, April)
- [Public] *Weird. Random. Quantum.*; Gozo Café Scientifique (Gozo, March)
- *Phonon dynamics in optomechanical arrays*; Max Planck Institute for the Science of Light (Erlangen, March)
- 2016 • [Invited] *Science Policy in Malta*; Xjenza20—The 20<sup>th</sup> anniversary of the journal of the Malta Chamber of Scientists (Malta, September)
- [Invited] *The quantum flagship: Opportunities for the nanoscale quantum optics community*; CMD26—The European Physical Society Condensed Matter Division Conference (Groningen, September)
- [Invited] *From quantum weirdness to quantum technologies*; ICPS2016—The International Conference of Physics Students (Malta, August)
- *Phonon dynamics in optomechanical arrays*; Universidad de la Habana (Havana, June)
- *Quantum Malta*; talk given at the offices of the Malta Communications Authority (Malta, April)
- [Invited] *Optomechanical arrays and thermodynamics of harmonic oscillators*; 1<sup>st</sup> UK Optomechanics Day (London, April)
- [Invited] *Weird. Random. Quantum.*; at the *Breaking Barriers* conference at the Junior College (Malta, April)

- *The Light Fantastic*; part of an International Year of Light event discussing the importance of photonics to the economy (Malta, March)
- *Phonon dynamics in optomechanical arrays*; TU Delft (Delft, February)
- 2015 • [Public] *Rise of the quantum machines*; a Malta Café Scientifique talk about quantum thermodynamics given to the general public (Malta, December)
- *Thermodynamics of trajectories of harmonic oscillators*; Institute for Theoretical Physics II, University of Erlangen-Nuremberg (Erlangen, November)
- *Thermodynamics of trajectories of harmonic oscillators*; Physics Division, School of Science and Technology, University of Camerino (Camerino, October)
- [Public] *Weird. Random. Quantum.*; a Malta Café Scientifique Highlights talk about quantum mechanics given to the general public as part of Science in the City, European Researchers' Night 2015 (Malta, September)
- *Thermodynamics of trajectories of a harmonic oscillator coupled to  $N$  baths*; 2<sup>th</sup> Quantum Thermodynamics Conference (Mallorca, April)
- *Optomechanics – A platform for nanoscale quantum optics*; COST Action MP1403 kickoff workshop (Belgrade, April)
- *Thermodynamics of trajectories*; Institute for Theoretical Physics, Leibniz University Hannover (Hannover, February)
- *Dynamical symmetries and crossovers in spin systems with collective dissipation*; Workshop on Quantum Information and Thermodynamics (São Carlos, February)
- [Public] *Weird. Random. Quantum.*; a Malta Café Scientifique talk about quantum mechanics given to the general public (Malta, February)
- [Invited] *Quantum Communications*; talk given at the offices of the Malta Communications Authority (Malta, February)
- 2014 • [Invited] *Phonon dynamics in optomechanical arrays*; QThYES 2014: Quantum technologies – hybrid emitter–solid state systems (Strasbourg, September)
- 2013 • [Invited] *Collective interactions and phonon dynamics in optomechanical arrays*; Cavity Optomechanics – from the micro- to the macro scale (Innsbruck, November)
- *Strong Coupling in Multielement Optomechanics*; February 2013 SFB Meeting (Innsbruck, February; Palermo, April; Catania, April; Aarhus, August)
- 2012 • *Quantum Mechanics at the Meso-Scale*; Lindau Nobel Laureates Meeting 2012 dedicated to Physics (Lindau, July)
- *Optomechanics: Quantum Mechanics at the Meso-Scale*; Quantum Malta 2012 (Malta, April)
- 2011 • *Dissipative Optomechanics in a Michelson–Sagnac Interferometer*; QOMNS 2011 (Ascona, July)
- 2010 • [Invited] *Cooling polarisable particles with an optical memory*; University of Malta (Malta, November)
- [Invited] –; Leibniz University Hannover (Hannover, November)
- [Invited] –; Institute for Quantum Optics and Quantum Information (IQOQI; Innsbruck, July)
- [Invited] –; University of Vienna (Vienna, June)
- *Laser cooling using the dissipative dipole force*; University of Southampton School of Physics and Astronomy weekly QLM Seminar (Southampton, February)
- 2009 • *Scattering theory of light–matter interactions*; 2nd UK Atom–Cavity Network Meeting (Leeds, December)
- *Scattering theory of cooling in optomechanical systems*; CMMC09 Workshop (Obergurgl, February)
- 2008 • *Cooling of atoms using nanostructured surfaces*; University of Southampton School of Physics and Astronomy weekly QLM Seminar (Southampton, December)

## Posters

- 2017 • *Quantum Islands*; Science in the House 2017 (Valletta, MT)
- 2016 • *Hybrid optomechanical technologies*; Science in the House 2016 (Valletta, MT)
- *Thermodynamics of trajectories of harmonic oscillators*; 605. Wilhelm und Else Heraeus Seminar on Macroscopic Entanglement (Bad Honnef, DE), GRC 2016 (Ventura, US), IQIS16 (Rome, IT)
- 2014 • *Reconfigurable long-range phonon dynamics in optomechanical arrays*; GRC 2014 (Ventura, US)
- 2013 • *An Optomechanical Interface for Matter-Wave Interferometry*; C3QS 2013 (Okinawa, JP)
- 2012 • *Strong coupling and long-range collective interactions in optomechanical arrays*; GRC 2012 (Galveston,

US)

- 2011 • *Multipartite optomechanical entanglement from competing nonlinearities*; GRC 2012 (Galveston, US)
- 2011 • *Dissipative optomechanics in interferometric setups*; QOMNS 2011 (Ascona, 2011), GRC 2012 (Galveston, US)
- 2010 • *Cooling atoms, particles and polarisable objects using the dissipative dipole force*; International Conference on Quantum Optics (Oberurgl, AT), Final CMMC Meeting (Herrsching, DE), ICAP 2010 (Cairns, AU), and EuroQUAM2010 (Ischgl, AT)
- *Novel Optical Cooling Methods for Atoms and Molecules*; University of Southampton FESM Research Showcase 2010 (Southampton, UK); explains author's research to non-specialists
- 2009 • *Scattering theory of cooling in optomechanical systems*; ICOLS09 (Hokkaido, JP)
- *Novel Optical Cooling Methods for Atoms and Molecules*; University of Southampton FESM Research Showcase 2009 (Southampton, UK); explains author's research to non-specialists
- 2008 • *Novel Optical Cooling Methods for Atoms and Molecules*; Photon08 (Edinburgh, 2008) and Les Houches School (Les Houches, FR)
- *Semiclassical Theory of Coherent Atom Cooling with a Single Mirror*; EuroQUAM Inaugural Conference (Barcelona, ES)

### Exhibitions

- 2018 • *Hybrid Optomechanical Technologies*; ICT2018 (Vienna, December)

### Outreach

- 2017 • Worked on an interactive light-based installation that brings the science behind radiation pressure to the general public; part of Science in the City 2017. Over a five-hour period an estimated 1,200 audience members interacted directly with the installation and about the same number indirectly.
- Guest on radio station XFM Malta, during the show *The Big Drive Home, with Trudy Kerr*; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies," the importance of research, and the installation "Light Pushes Stuff," in Science in the City 2017.
- Gave a public lecture, *Weird. Random. Quantum.*, as part of the Gozo Café Scientifique series of lectures.
- Guest on radio station Radju Malta 2, during the show *Radio Mocha Malta*; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies" and the importance of basic research
- Interviewed on local television station TVM; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies" and the importance of basic research
- 2016 • Interviewed on local television station Net TV; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies" and the importance of basic research
- Interviewed on local online news portal Newsbook.com.mt; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies" and the importance of basic research
- Guest on radio station Radju Malta, during the show *Familja Wahda*; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies" and the importance of basic research
- Guest on television station TVM, during the show *Twelve2three*; discussed the Horizon 2020 research project "HOT—Hybrid Optomechanical Technologies" and the importance of basic research
- Contributor to "Sounds of science," a science-themed section published weekly on the Sunday Times of Malta.
- Guest on radio station Radju Malta 2, during the show *Radio Mocha Malta*; discussed quantum thermodynamics
- 2015 • Gave a public lecture, *Rise of the quantum machines*, as part of the Malta Café Scientifique series of lectures.
- Guest on radio station Radju Malta 2, together with Dr Edward Duca, during the show *Radio Mocha Malta*; discussed science policy



- Guest on University of Malta radio station during the show *University Matters*; discussed quantum mechanics and quantum technology
- Public lecture, *Weird. Random. Quantum.*, as part of the Malta Café Scientifique Highlights event at Science in the City, European Researchers' Night 2015.
- Organised a visit to Malta by Prof. Anton Zeilinger, who gave a public lecture *Teleportation... and what is light?* attended by over 300 members of the general public. Discussions held with members of the Government of Malta and other stakeholders regarding the status of fundamental scientific research in Malta. Interviews carried on local newspapers
- Gave a public lecture, *Weird. Random. Quantum.*, as part of the Malta Café Scientifique series of lectures.
- 2014 • Organised a visit to Malta by Prof. Vlatko Vedral, who gave a public lecture *Decoding Reality* attended by ca. 300 members of the general public. Discussions held with members of the Government of Malta regarding research in quantum information. Interviews carried on local TV and newspapers
- 2013 • Article on The Sunday Times of Malta discussing optomechanics and participation in the Falling Walls Labs
- *The exotic world of the very small*; article on the University of Malta research magazine Think about work in quantum mechanics
- 2011 • Organised a visit to Malta by Nobel Laureate Prof. William D. Phillips, who gave a public lecture *Time, Einstein, and the Coolest Stuff in the Universe* attended by over 300 members of the general public. Discussions also held with members of the Government of Malta regarding basic science research. Interviews carried on local TV and newspapers

## Courses taught

- Summary** Lectured in several fields of physics, spanning the years 2011 to date, in several countries.
- 2017– • *Quantum Optics*, a fourth-year physics unit at the University of Malta
  - 2017– • *Quantum Mechanics*, a revised second-year physics unit at the University of Malta
  - 2015–2017 • *Quantum Mechanics II*, a second-year physics unit at the University of Malta
  - 2014– • Supervision of fourth-year projects in the Physics Department at the University of Malta
  - 2014– • *Atomic Physics*, a third-year physics unit at the University of Malta
  - 2015 • *Optomechanics*, a series of lectures given at the Winter School on Physics of Small Quantum Systems: Thermal and Topological Phenomena, a COST Action MP1209 activity (Helsinki, Finland)
  - 2014–2015 • *Statistical Mechanics*, a third-year physics unit at the University of Malta
  - 2013 • *Continuous-Variable Quantum Optics*, a series of lectures given to post-graduate students and staff at Universidade Federal de Goiás (Goiânia, Brazil)
  - 2012 • *Tensor Field Theory*, a third-year unit, given in conjunction with Dr L Mazzola and Dr M Paternostro at Queen's University Belfast
  - 2011 • A series of lectures on *laser cooling*, *quantum optics*, and *quantum optomechanics* given to third-year students at the University of Malta, as part of the Physical Optics course

## Conferences and courses

### Conferences organised

- 2017 • **Local organiser** of the EL-CSID Workshop on Diplomacy and Development, 27–28 April (Qawra, MT)
- **Co-chair and organiser** of the CA15220 “Quantum Technologies in Space” Conference and Working Group Meeting, 26–31 March (Valletta, MT)
- **Co-host and local organiser** of Quantum Europe 2017, a European Commission Conference regarding the forthcoming Quantum Technology Flagship, 17 February (Attard, MT)
- **Local organiser** of QuantERA Proposers' Day, an information session about the forthcoming QuantERA call, 16 February (Floriana, MT)
- 2016 • **Chair and organiser** of the MP1209 “Thermodynamics in the Quantum Regime” 6<sup>th</sup> Working



- Group Meeting, 21–24 February (Attard, MT)
- 2015 • **Chair and organiser** of the MP1403 “Nanoscale Quantum Optics” Early-Stage Researcher Workshop, 15–18 November (Attard, MT)
- 2014 • **Co-chair**, together with Dr Swati Singh, of the first Gordon Research Seminar on ‘Mechanical Systems in the Quantum Regime,’ 8–9 March (Ventura, US)

### Conferences & meetings attended

- 2018 • ICT2018—Imagine Digital - Connect Europe, 4–6 December (Vienna, AT). Conference and exhibition organised by the European Commission and the Austrian Presidency of the Council of the European Union. Attended on behalf of and exhibited the Hybrid Optomechanical Technologies project
- INGSA2018—Science Advice for a Changing World, 6–7 November (Tokyo, JP). The 2018 conference of the International Network for Government Science Advice
- Global Young Academy—Japan Young Academy—Science Council of Japan Capacity Building Workshop, 5 November (Tokyo, JP). Invitation-only workshop on Science Leadership and Science Advice, developed by the Global Young Academy and the Young Academy of Japan. Satellite meeting of INGSA2018
- Malta Innovation Summit 2018, 12 October (St Julians, MT). Invited talk given
- IQIS18, 17–20 September (Catania, IT). 2018 edition of the Italian Quantum Information Science conference. Talk given
- ESC 2018, 2–7 September (Valletta, MT). The 36<sup>th</sup> General Assembly of the European Seismological Commission
- EUSEA 2018, 17–18 May (Madrid, ES). European science engagement conference. Contributed talk given
- International Day of Light 2018, 16 May (Paris, FR). UNESCO conference to commemorate the international day of light and light-based technologies
- SPIE Photonics Europe 2018, 23–26 April (Strasbourg, FR). Invited talk given
- GRC 2018, 25 February–2 March (Ventura, US). The fifth Gordon Research Conference on ‘Mechanical Systems in the Quantum Regime’
- Nanoscale Quantum Optics Conference and MC Meeting, 13–16 February (Prague, CZ). Conference and Management Committee meeting of the COST Action MP1403—Nanoscale Quantum Optics
- Meeting of the Asian Young Academies, 11–12 February (Jerusalem, IL). Represented the University of Malta and the Malta Chamber of Scientists. Talk given
- OMT–HOT 2018, 15–18 January (Saanen, CH). Annual network meeting of the HOT and OMT Horizon 2020 networks. Talk given
- 2017 • Science in the House 2017, 29 September (Valletta, MT). Presentation of selected Maltese research to members of parliament. Poster presented
- Foundations and Applications of Nanomechanics, 25–29 September (Trieste, IT)
- Lisbon Training Workshop on Quantum Technologies in Space, 11–14 September (Lisbon, PT)
- Quantum Optics to Quantum Technology, 11–14 July (London, UK)
- Commonwealth Science Conference 2017, 13–16 June (Singapore, SG)
- Global Young Academy Annual General Meeting 2017, 15–19 May (Aviemore, UK)
- CA15220 “Quantum Technologies in Space” Conference and Working Group Meeting, 26–31 March (Valletta, MT). Organised and co-chaired workshop on behalf of COST Action CA15220
- 5<sup>th</sup> Quantum Thermodynamics Conference, 13–17 March (Oxford, UK)
- Quantum Europe 2017, 17 February (Attard, MT). Co-host and local organiser
- QuantERA Proposers’ Day, 16 February (Floriana, MT). Information session about the forthcoming first call of the QuantERA initiative. Short talk given introducing Maltese quantum research; local organiser
- 2016 • Science in the House 2016, 29 September (Valletta, MT). Presentation of selected Maltese research to members of parliament. Poster presented
- Xjenza20, 23 September (Valletta, MT). Celebration on the occasion of the 20<sup>th</sup> anniversary of the journal of the Malta Chamber of Scientists. Invited talk given

- IQIS16, 20–23 September (Rome, IT). 2016 edition of the Italian Quantum Information Science conference. Poster presented
- CMD26, 4–9 September (Groningen, NL). Conference of the Condensed Matter Division of the European Physical Society. Invited talk given
- ICPS2016, 11–17 August (MT). International Conference of Physics Students. Invited keynote talk given
- Quantum Europe 2016, 17–18 May (Amsterdam, NL). Event organised by the Dutch presidency of the European Council. Representative of the Government of Malta
- Quantum Technology for the 21<sup>st</sup> Century, 9–10 May (London, UK). Event organised by the Royal Society. Representative of the Government of Malta
- Italian Internet Day, 28 April (Pisa, IT). Celebration of the 30<sup>th</sup> anniversary of Italy's connection to the Internet. Invited by organisers
- 1<sup>st</sup> UK Optomechanics Day, 13 April (London, UK). Invited talk given
- Breaking Barriers, 12 April (MT). One-day conference on teaching science as well as research being conducted in Malta. Invited talk given
- GRC 2016, 6–11 March (Ventura, US). The fourth Gordon Research Conference on 'Mechanical Systems in the Quantum Regime'. Poster presented
- MP1209 "Thermodynamics in the Quantum Regime" 6<sup>th</sup> Working Group Meeting, 21–24 February (Attard, MT). Organised and chaired workshop on behalf of COST Action MP1209
- Quantum Spacetime '16, organised by COST Action MP1405, 6–12 February (Zakopane, PL)
- 605. Wilhelm und Else Heraeus Seminar on Macroscopic Entanglement, 17–22 January (Bad Honnef, DE). Poster presented
- 2015 • 7<sup>th</sup> European Innovation Summit, 7–10 December (Brussels, BE). Invited to attend debate "Quantum technologies: Entangling Europe for innovation" on behalf of Malta
- MP1403 "Nanoscale Quantum Optics" Early-Stage Researcher Workshop, 15–18 November (Attard, MT). Organised and chaired workshop on behalf of COST Action MP1403
- Quantum Physics of Nature (QuPoN) 2015, 18–22 May (Vienna, AT)
- 2<sup>nd</sup> Quantum Thermodynamics Conference, 20–24 April (Mallorca, ES). Talk given
- Kickoff meeting of COST Action MP1403, 9–10 April (Belgrade, RS). Talk given
- Workshop on Quantum Information and Thermodynamics, 23–27 February (Saõ Carlos, BR). Talk given
- Winter School on Physics of Small Quantum Systems: Thermal and Topological Phenomena, 12–16 January (Helsinki, FI). Lecture course on optomechanics given
- 2014 • QThYES 2014: Quantum technologies – hybrid emitter–solid state systems, 21–24 September (Strasbourg, FR). Talk given
- 3<sup>rd</sup> Working Group meeting of COST Action MP1209, 18–20 August (Belfast, UK)
- Kickoff meeting of FP7 Action TherMiQ, 20–21 March (Belfast, UK)
- GRC 2014, 10–14 March (Ventura, US). The third Gordon Research Conference on 'Mechanical Systems in the Quantum Regime'. Poster presented
- GRS 2014, 8–9 March (Ventura, US). The first Gordon Research Seminar on 'Mechanical Systems in the Quantum Regime'. Co-chaired with Dr Swati Singh; work on multi-element optomechanics discussed by Claudiu Genes in an invited talk
- 2<sup>nd</sup> Working Group meeting of COST Action MP1209 & Thermodynamics in the Quantum Regime conference, 20–24 January (Berlin, DE)
- 2013 • Falling Walls 2013, 8–9 November (Berlin, DE). Event that acts as "a unique international platform for leaders from the worlds of science, business, politics, the arts and society." Talk given at Falling Walls Labs
- Cavity Optomechanics – from the micro- to the macro scale, 4–6 November (Innsbruck, AT). Workshop exploring the latest research in optomechanics in both mechanical and atomic systems. Invited talk given
- C3QS 2013, 5–12 May (Okinawa, JP). Conference on the 'Coherent Control of Complex Quantum Systems' at the Okinawa Institute for Science and Technology. Poster presented
- 2012 • Lindau Nobel Laureates Meeting 2012, 1–6 July (Lindau, DE). Conference bringing together over twenty Nobel laureates in physics, chemistry, and medicine or physiology, and a number of

'Young Researchers' from around the world; invited by, and attended on behalf of, the University of Malta. Talk given

- Quantum Malta 2012, 24–27 April (Valletta, MT). Conference on 'Fundamental Problems in Quantum Physics'. Talk given
- GRC 2012, 4–9 March (Galveston, US). The second Gordon Research Conference on 'Mechanical Systems in the Quantum Regime'. Three posters presented; work on dissipative optomechanics discussed by Klemens Hammerer in an invited talk
- 2011 • QOMNS 2011, 24–28 July (Ascona, CH). Conference on the 'Quantum Optics of Micro- and Nanomechanical Systems'. Poster presented and talk given
- 2010 • EuroQUAM2010 – Cold Quantum Matter: Achievements and Prospects, 12–16 September (Ischgl, AT). The final meeting of the EuroQUAM network. Poster presented
- ICAP2010, 25–30 July (Cairns, AU). One of the main international conferences dealing with atomic physics. Poster presented
- Final CMMC Meeting, 28–31 March (Herrsching, DE). The final meeting of the CMMC (cavity-mediated molecular cooling) EuroQUAM project. Poster presented
- Interfacing Matter and Light by Cavity-QED, 22 March (Oxford, UK). One-day meeting discussing the use of cavities in mediating light-matter interactions
- International Conference on Quantum Optics, 21–26 February (Oberurgl, AT). Meeting discussing the current work in quantum optics. Poster presented
- 2009 • 2nd UK Atom-Cavity Network Meeting, 15 December (Leeds, UK). Meeting of several UK groups researching cold atoms and atom-cavity interactions. Talk given
- ICOLS09, 7–12 June (Hokkaido, JP). One of the main international conferences dealing with laser spectroscopy. Poster presented
- CMMC09 Workshop, 4–9 February (Oberurgl, AT). Meeting discussing the current work in cavity-mediated molecular cooling and related areas. Talk given
- 2008 • Photon08, 26–29 August (Edinburg, UK). Biannual conference on optics and photonics organised by the Institute of Physics. Poster presented
- EuroQUAM Inaugural Conference, 7–9 April (Barcelona, ES). Conference on cold and quantised matter organised by the European Science Foundation. Poster presented

### **Courses attended**

- 2014–2015 • Professional Development of Academic Staff (Malta). Initiative by the University of Malta for new staff members to undergo training in pedagogy and course development
- 2010 • GRADschool, 2–5 March (Windermere, UK). Research council initiative for developing both skills related to the PhD course as well as general transferable skills
- 2008 • Les Houches School, 28 September – 10 October (Les Houches, FR). Biannual course on laser cooling and Bose-Einstein condensation. Poster presented
- 2007 • CERN Summer School, 3 July – 28 August (Geneva, CH). Summer school in accelerator and particle physics at the European Centre for Nuclear Research (CERN)

### **Work experience**

- 07–08/2007 Worked as a summer student as part of a team studying the trigger detectors to be used in the CMS and ATLAS experiment in the LHC at CERN
- 06–08/2006 Summer traineeship, through IAESTE (International Association for the Exchange of Students for Technical Experience), working in the Advanced Energy Systems Laboratory at the Helsinki University of Technology (TKK, now Aalto University) in Otaniemi, Finland. Worked on the computer modelling of the dispersion of carbon in fusion reactors
- 2006 Gave private tuition to students for the Pure Mathematics exam at 'A' level
- 2003–2007 Freelance design and programming of web sites, gaining experience in the use of PHP and MySQL. Also some minor programming jobs in Delphi

## Services to the profession

### Summary

On editorial boards including that of New Journal of Physics. I regularly referee journal articles from various leading international physics journals, and have reviewed and monitored projects funded by the European Commission.

- On the editorial board of: *New Journal of Physics* (since January 1, 2019), *Journal of Physics Communications*
- Referee for: *Nature*, *Nature Communications*, *Physical Review Letters*, *Physical Review X*, *Physical Review A*, *Physical Review B*, *New Journal of Physics*, *Journal of Physics B*, *European Physical Journal D*, *Physics Letters A*, *Progress in Electromagnetics Research Letters*, *Journal of Optics*, *Journal of Statistical Mechanics*, etc.
- Referee for European Cooperation in Science and Technology (COST) Action proposals
- Monitor for European Commission projects funded under Framework Programme Seven (FP7)
- Jury member for PhD defenses

## Additional information

### Languages

- Native Maltese
- Native English
- Good Italian
- Can understand basic German

### Information technology

Can program in C/C++, Python, Pascal (and Delphi), HTML, PHP, JavaScript and CSS. Some experience in FORTRAN, Java and Perl as well as in using MySQL. Fluent and frequent user of the L<sup>A</sup>T<sub>E</sub>X typesetting system. Familiar with Microsoft Windows and MS-DOS. Experienced with Linux and \*nix shells. Well-versed in the use of computers to interface with and control laboratory equipment. Reasonably good soldering skills and some experience in designing and building circuits for controlling and stabilising laboratory equipment.