

CONTACT INFORMATION	Max Planck Institute for the Physics of Complex Systems Nöthnitzer Straße 38, 01187 Dresden, Germany	Website: <a href="https://shovandutta.org/">https://shovandutta.org/</a> Email: <a href="mailto:sdutta@pks.mpg.de">sdutta@pks.mpg.de</a>
ACADEMIC POSITION	Guest Scientist, Condensed Matter Max Planck Institute for the Physics of Complex Systems Contact: Prof. Roderich Moessner	Oct 2021 - present
	Postdoctoral Research Associate [TCM website] University of Cambridge, Cavendish Laboratory Supervisor: Prof. Nigel Cooper	Sep 2018 - Sep 2021
EDUCATION	Cornell University, Ithaca, USA Ph.D. in Physics (Theoretical) Advisor: Prof. Erich Mueller Dissertation: <a href="#">Collective Phenomena in Quantum Gases</a>	Aug 2012 - Aug 2018
	Jadavpur University, Kolkata, India B.E. in Electronics and Tele-Communication Engineering 1st class with Honours, CGPA: 9.42/10	Jul 2008 - Jul 2012
AWARDS AND ACADEMIC ACHIEVEMENTS	Postdoctoral Fellowship offers: <ul style="list-style-type: none"> <li>• <a href="#">International Centre for Theoretical Physics (ICTP)</a>, Trieste, 2021 [<a href="#">Rosario Fazio</a>]</li> <li>• <a href="#">Center for Theory of Quantum Matter (CTQM)</a>, CU Boulder, 2020 [<a href="#">Ana Maria Rey</a>]</li> <li>• <a href="#">Max Planck-Harvard Research Center for Quantum optics (MPHQ)</a>, 2018 [<a href="#">J. Ignacio Cirac</a>]</li> </ul> Research Associateship at <a href="#">Darwin College</a> , Cambridge, 2018-21 Dr. V. Ramachandra Rao Summer Fellowship, Cornell University, 2013 Hartmann Memorial Teaching Award, Cornell University, 2012-13 <a href="#">Dr. Shyama Prasad Mukherjee (SPM) Fellowship</a> offer from CSIR, India, 2012 1st all over India in competitive entrance exams for PhD in Physics: <ul style="list-style-type: none"> <li>• CSIR National Eligibility Test (<a href="#">NET</a>), June 2012</li> <li>• Joint Entrance Screening Test (<a href="#">JEST</a>), 2012</li> <li>• Graduate Aptitude Test in Engineering (<a href="#">GATE</a>), 2011</li> </ul> Jadavpur University Medals in different engineering subjects, 2012: (i) Prof. J. C. Memorial Gold Medal, (ii) Prof. D. M. Memorial Silver Medal, (iii) M. N. C. Memorial Bronze Medal, (iv) Indu Bhusan and Shanti Sudha Putatunda Memorial Award (2010) Best paper award in National Students Paper and Circuit Design Contest ( <a href="#">NSPCDC</a> ) 2011, organised by IEEE [paper available at <a href="https://tinyurl.com/y4wuuedl">https://tinyurl.com/y4wuuedl</a> ] Late Supriya Basu Scholarship from Jadavpur University <a href="#">Alumni Association (Mumbai)</a> , 2010, for highest grade in all engineering departments 1st among 67,655 students in the West Bengal Joint Entrance Examination ( <a href="#">WBJEE</a> ) in Engineering, 2008 [ <a href="#">news article</a> on The Telegraph] – Gold Medal from Howrah Zilla School 2nd in Achievement-cum-Diagnostic Test in Mathematics ( <a href="#">ADTM</a> ), West Bengal, 2007	
RESEARCH ACHIEVEMENTS	Discovered a hidden symmetry that stabilises controllable long-range entanglement in a lossy qubit array [ <a href="#">PRL '20</a> , <a href="#">PRR (Letter) '21</a> ], accessible by a simple pulse sequence [in preparation]	

Predicted tuneable (dis)continuous quantum phase transitions in a resonantly shaken 1D lattice, confirmed by Ulrich Schneider’s experimental group [Accepted in [Nature Physics](#) (pdf)]

Developed a novel computational technique reformulating the Density-Matrix Renormalisation Group (DMRG) for continuous quantum systems [[arXiv ’21](#), [Open-source code](#)]

Showed how a dissipative quantum nonlinear oscillator close to a dynamical critical point can sense very weak signals, beyond what is possible classically or in a passive system [[PRL ’19](#)]

Devised a protocol for preparing photonic fractional quantum Hall states and braiding topological excitations in an optical cavity, in close contact with ongoing experiments [[PRA ’18](#)]

Discovered a dynamical instability of domain walls in a Fermi gas [[PRL ’17](#)] and showed how they can be efficiently driven to a long-sought-after (FFLO) superfluid state [[PRA ’17](#)]

PUBLICATIONS [Summary, slides, posters, and illustrations updated at <https://shovandutta.org/#publications>] [[arXiv](#)] [[ORCID](#)]

PUBLISHED/  
ACCEPTED  
PAPERS

10. Bo Song, **Shovan Dutta**, Shaurya Bhawe, Jr-Chiun Yu, Ed Carter, Nigel R. Cooper, and **Ulrich Schneider**, “Realizing discontinuous quantum phase transitions in a strongly-correlated driven optical lattice,” Accepted in *Nature Physics* [pdf] [[arXiv:2105.12146](#)] [slides].  
– Performed all theoretical modelling and made predictions which guided the experiment.
9. **Shovan Dutta** and Nigel R. Cooper, “Out-of-equilibrium steady states of a locally driven lossy qubit array,” *Phys. Rev. Research (Letter)* 3, L012016 (2021) [pdf] [[arXiv:2007.08938](#)].
8. **Shovan Dutta** and Nigel R. Cooper, “Long-Range Coherence and Multiple Steady States in a Lossy Qubit Array,” *Phys. Rev. Lett.* 125, 240404 (2020) [pdf] [[arXiv:2004.07981](#)] [press release] [slides].
7. **Shovan Dutta** and Nigel R. Cooper, “Critical Response of a Quantum van der Pol Oscillator,” *Phys. Rev. Lett.* 123, 250401 (2019) [pdf] [[arXiv:1908.01002](#)] [TCM highlight] [slides].
6. **Shovan Dutta** and Erich J. Mueller, “Coherent generation of photonic fractional quantum Hall states in a cavity and the search for anyonic quasiparticles,” *Phys. Rev. A* 97, 033825 (2018) [pdf] [[arXiv:1711.08059](#)] [news story] [slides].
5. **Shovan Dutta** and Erich J. Mueller, “Protocol to engineer Fulde-Ferrell-Larkin-Ovchinnikov states in a cold Fermi gas,” *Phys. Rev. A* 96, 023612 (2017) [pdf] [[arXiv:1706.00994](#)].
4. **Shovan Dutta** and Erich J. Mueller, “Collective Modes of a Soliton Train in a Fermi Superfluid,” *Phys. Rev. Lett.* 118, 260402 (2017) [pdf] [[arXiv:1612.04845](#)] [news story] [slides].
3. **Shovan Dutta** and Erich J. Mueller, “Dimensional crossover in a spin-imbalanced Fermi gas,” *Phys. Rev. A* 94, 063627 (2016) [pdf] [[arXiv:1508.03352](#)].
2. **Shovan Dutta** and Erich J. Mueller, “Kinetics of Bose-Einstein condensation in a dimple potential,” *Phys. Rev. A* 91, 013601 (2015) [pdf] [[arXiv:1407.2557](#)].
1. **Shovan Dutta** and Erich J. Mueller, “Variational study of polarons and bipolarons in a one-dimensional Bose lattice gas in both the superfluid and the Mott-insulator regimes,” *Phys. Rev. A* 88, 053601 (2013) [pdf] [[arXiv:1308.4876](#)] [slides].

UNDER REVIEW

2. **Shovan Dutta**, Anton Buyskikh, **Andrew J. Daley**, and Erich J. Mueller, “Density-Matrix Renormalization Group for Continuous Quantum Systems,” [arXiv:2108.05366](#) (2021) [open-source code] [slides].  
– Developed and benchmarked the technique from scratch.
1. **Liam L.H. Lau** and **Shovan Dutta**, “Quantum walk of two anyons across a statistical boundary,” [arXiv:2012.03977](#) (2020) [updated pdf]  
– Conceived, supervised, and contributed to analysis.

- IN PREPARATION 1. **Shovan Dutta**, **Stefan Kuhr**, and Nigel R. Cooper, “Pulsed Generation of Symmetry-Protected Long-Range Entanglement”
- OLDER PREPRINTS 4. **Shovan Dutta** and **Subhankar Ray**, “Damped bead on a rotating circular hoop - a bifurcation zoo,” [arXiv:1201.1218](https://arxiv.org/abs/1201.1218) (2012).
3. **Shovan Dutta** and Subhankar Ray, “Bead on a rotating circular hoop: a simple yet feature-rich dynamical system,” [arXiv:1112.4697](https://arxiv.org/abs/1112.4697) (2011).
2. **Shovan Dutta**, Subhankar Ray, and **J. Shamanna**, “Continuous Time Random Walk with time-dependent jump probability: A direct probabilistic approach,” [arXiv:1112.3253](https://arxiv.org/abs/1112.3253) (2011).
1. **Shovan Dutta**, “A simple circuit model showing feature-rich Bogdanov-Takens bifurcation.” Selected as the best paper in the IEEE National Students Paper and Circuit Design Contest, 2011. Available at <https://tinyurl.com/y4wuuedl>.
- COLLABORATORS **Nigel Cooper** (Cambridge), **Erich Mueller** (Cornell), **Ulrich Schneider** (Cambridge), **Andrew Daley** (Strathclyde), **Stefan Kuhr** (Strathclyde), **Jon Simon** (Chicago), Bo Song (Cambridge), Anton Buyskikh (Riverlane)
- SELECTED TALKS
- (Invited) “Hidden symmetry and long-range entanglement in a lossy qubit array,” Quantum Optics [Group Meeting](#) (online), University of Liège, November 2021
  - “DMRG for continuous systems,” Condensed Matter and Quantum Materials ([CMQM](#)) Conference (online), June 2021 [[video](#)]
  - (Invited) “Hysteretic quantum phase transitions in a strongly-correlated driven optical lattice,” [Physics of Quantum Materials Seminar](#) (online), University of Kent, June 2021
  - (Invited) “Long-range entanglement and multiple steady states in a lossy qubit array,” [Theoretical Physics Seminar](#) (online), University of Birmingham, March 2021
  - “Out-of-Equilibrium Steady States of Driven Lossy Qubit Arrays,” [Many Body Physics in Open Quantum Systems](#), Princeton Center for Theoretical Science, Jan 2021 [[video](#)]
  - “Long-range entanglement and multiple steady states in a lossy qubit array,” Stat. Phys. Journal Club [Seminar](#), International Centre for Theoretical Sciences (ICTS), Jan 2021
  - “Long-range entanglement and multiple steady states in a lossy qubit array,” [Random Interactions Seminar](#), Tata Institute of Fundamental Research (TIFR), November 2020 [[video](#)]
  - “Long-range entanglement and multiple steady states in a lossy qubit array,” Department of Physics [Seminar](#), Indian Institute of Technology (IIT) Bombay, November 2020
  - “Long-range coherence and multiple steady states in a lossy qubit array,” Center for Theory of Quantum Matter (CTQM) Seminar, CU Boulder, November 2020
  - “Critical Response of a Quantum van der Pol Oscillator,” Centre for Condensed Matter Theory (CCMT) Seminar, Indian Institute of Science (IISc), December 2019
  - “Critical Response of a Quantum van der Pol Oscillator,” [Joint DesOEQ-QSUM meeting](#), University of Oxford, September 2019
  - “Critical Response of a Quantum van der Pol Oscillator,” Condensed Matter and Quantum Materials ([CMQM](#)) Conference, University of St Andrews, July 2019
  - “Paving an enlightened path to anyons and quantum computation,” [Science Lunchtime Seminar](#), Darwin College, University of Cambridge, April 2019
  - “Collective Dynamics of Solitons in Superfluids,” Research highlight for prospective graduate students, Department of Physics, Cornell University, March 2017
- POSTERS Please see <https://shovandutta.org/#posters> for a list

RESEARCH SUPERVISION	Designed and supervised a full research project for a Master's physics student in Cambridge – <a href="https://arxiv.org/abs/2012.03977">arXiv:2012.03977</a> (2020) [ <a href="#">updated pdf</a> ]
TEACHING EXPERIENCE	<ul style="list-style-type: none"> <li>• Head of class and co-examiner for <b>TP2: Advanced Quantum Mech.</b>, Cambridge, Lent 2020</li> <li>• Supervisor for <b>Part IB Physics A: 2nd year Natural Sciences</b>, Cambridge, 2018-19 Experimental methods, Waves, Quantum physics, Condensed matter physics</li> <li>• Teaching assistant for a diverse set of undergraduate courses at Cornell University, 2012-16 Electromagnetism, Mechanics &amp; special relativity, and courses for non-physics majors Detailed list of courses and student evaluations available at <a href="http://shovandutta.org/teaching/">shovandutta.org/teaching/</a></li> </ul>
PUBLIC ENGAGEMENT	<p>Newspaper articles and research highlights written for a general audience:</p> <ul style="list-style-type: none"> <li>• <a href="#">Hidden symmetry could be key to more robust quantum systems, researchers find</a></li> <li>• <a href="#">Researchers pave an enlightened path to anyons and quantum computation</a></li> <li>• <a href="#">Surprising nature of quantum solitary waves revealed</a></li> <li>• <a href="#">A quantum ear</a></li> </ul> <p>Non-technical summary and illustrations of research on personal website: <a href="http://shovandutta.org">shovandutta.org</a></p> <p>Lunchtime seminars at Darwin college, Cambridge for non-physicists – see Talks above</p> <p>Short presentations on YouTube: <a href="https://tinyurl.com/yyqmc2d4">https://tinyurl.com/yyqmc2d4</a></p>
UNPUBLISHED RESEARCH	<ul style="list-style-type: none"> <li>• Understanding nucleation of superfluid B phase in <math>^3\text{He}</math>, 2018 (with E. Mueller and J. Parpia)</li> <li>• Thermalisation in a quasi-one-dimensional quantum gas, 2015 [<a href="#">manuscript</a>] [<a href="#">slides</a>]</li> <li>• Photoemission from thin semiconductor films, 2012 (with C. Bose and M. Bose)</li> <li>• Liquid-gas phase transition of cold nuclear matter, 2011 (with S. Ray and J. Shamanna)</li> </ul>
EDITORIAL	Regular referee for PRL (since 2017), PRA (since 2018), and PRB (since 2019)
ADMINISTRATIVE	Co-organised the <a href="#">Cavendish Quantum Colloquia</a> , 2018-19, University of Cambridge Group representative within the multi-university <a href="#">DesOEQ</a> programme grant, 2020-21