

CONTACT INFORMATION	TCM Group, Cavendish Laboratory University of Cambridge JJ Thomson Avenue, Cambridge CB3 0HE	Website: https://shovandutta.org/ Email: sd843@cam.ac.uk
ACADEMIC POSITION	Postdoctoral Research Associate Darwin College, Cambridge Supervisor: Prof. Nigel Cooper	September 2018 - present
EDUCATION	Cornell University , Ithaca, USA Ph.D. in Physics, 2018 Advisor: Prof. Erich Mueller Dissertation: Collective Phenomena in Quantum Gases	2012 - 2018
	Jadavpur University , Kolkata, India B.E. in Electronics and Tele-Communication Engineering 1st class with Honours, CGPA: 9.42/10	2008 - 2012
AWARDS AND ACADEMIC ACHIEVEMENTS	Postdoctoral Fellowship at Max Planck-Harvard Center for Quantum optics , 2018 (declined) Dr. V. Ramachandra Rao Summer Fellowship, Cornell University, 2013 Hartmann Memorial Teaching Award, Cornell University, 2012-13 Dr. Shyama Prasad Mukherjee (SPM) Fellowship from the Council of Scientific and Industrial Research (CSIR), India, 2012 1st all over India in the following competitive exams for research degrees in Physics: (i) CSIR National Eligibility Test (NET) 2012, (ii) Joint Entrance Screening Test (JEST) 2012, and (iii) Graduate Aptitude Test in Engineering (GATE) 2011 Jadavpur University medals in engineering subjects: (i) Prof. J. C. Memorial Gold Medal, 2012, (ii) Prof. D. M. Memorial Silver Medal, 2012, (iii) M. N. C. Memorial Bronze Medal, 2012, (iv) Indu Bhusan and Shanti Sudha Putatunda Memorial Award, 2010 Best paper award in National Students Paper and Circuit Design Contest (NSPCDC) 2011, organised by IEEE [paper available at https://tinyurl.com/y4wuuedl] Late Supriya Basu Scholarship from Jadavpur University Alumni Association (Mumbai Branch), 2010, for securing highest grade in all engineering departments 1st among 67,655 students in the West Bengal Joint Entrance Examination (WBJEE) in Engineering, 2008 [news article on The Telegraph] – Gold medal from Howrah Zilla School 2nd in the statewide Achievement-cum-Diagnostic Test in Mathematics (ADTM) 2007	
RESEARCH SUMMARY	My research is focused on predicting new quantum many-particle phenomena and their manifestations in experimental gases of atoms and photons. During PhD, I studied exotic phases of matter, collective excitations, and quantum dynamics of such systems. My recent work has explored novel out-of-equilibrium properties in the presence of drive and dissipation. I am also actively involved in developing widely applicable numerical techniques such as DMRG.	

RESEARCH
ACHIEVEMENTS

Discovered a dynamical instability of soliton trains in a Fermi gas [PRL '17] and showed how they can be systematically driven to a long-sought-after superfluid state [PRA '17]

Devised a realisable protocol for preparing fractional quantum Hall states and braiding topological excitations in an optical cavity, in collaboration with ongoing experiments [PRA '18]

Showed how a quantum limit-cycle oscillator close to a critical point can sense extremely weak signals, beyond what is possible classically or in a passive system [PRL '19]

Discovered a hidden symmetry that stabilises controllable long-range entanglement in a qubit array, and showed how to prepare such states in existing photonic setups [PRL '20]

Developed a computational technique that extends the Density Matrix Renormalisation Group to enable efficient simulation of continuous 1D quantum systems [manuscript in preparation]

PUBLICATIONS
& PREPRINTS

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

14. Liam L.H. Lau and **Shovan Dutta**, “Quantum walk of two anyons across a statistical boundary,” [arXiv:2012.03977](https://arxiv.org/abs/2012.03977) (2020)
13. **Shovan Dutta** and Nigel R. Cooper, “Out-of-equilibrium steady states of a locally driven lossy qubit array,” [arXiv:2007.08938](https://arxiv.org/abs/2007.08938) (2020)
12. **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] [TCM highlight]
11. **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]
10. **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] [supplement] [arXiv:1711.08059] [news story]
9. **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]
8. **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]
7. **Shovan Dutta** and Erich J. Mueller, “Dimensional crossover in a spin-imbalanced Fermi gas,” *Phys. Rev. A* **94**, 063627 (2016) [pdf] [arXiv:1508.03352]
6. **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]
5. **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]
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)

	<ol style="list-style-type: none"> 2. Shovan Dutta, Subhankar Ray, and J. Shamanna, “Continuous Time Random Walk with time-dependent jump probability: A direct probabilistic approach,” arXiv:1112.3253 (2011) 1. Shovan Dutta, “A simple circuit model showing feature-rich Bogdanov-Takens bifurcation,” IEEE link (2011) [won the National Students Paper and Circuit Design Contest 2011]
IN PREPARATION	<ol style="list-style-type: none"> 1. Shovan Dutta, Anton Buyskikh, Andrew J. Daley, and Erich J. Mueller, “Density Matrix Renormalisation Group for continuous systems”
NOTABLE TALKS	<ul style="list-style-type: none"> • “Long-range entanglement and multiple steady states in a lossy qubit array,” Random Interactions Seminar, Tata Institute of Fundamental Research, November 2020 [video link] • “Long-range entanglement and multiple steady states in a lossy qubit array,” Department of Physics Seminar, IIT Bombay, November 2020 • “Long-range coherence and multiple steady states in a lossy qubit array,” Center for Theory of Quantum Matter (CTQM) Seminar, University of Colorado Boulder, November 2020 • “Long-range entanglement and multistability in a lossy qubit array,” Collective Phenomena Group Meeting (CPGM) Seminar, University of Cambridge, July 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, Cambridge, April 2019 • “Creating and Braiding Anyons in an Optical Cavity,” Department of Physics Seminar, University of Strathclyde, January 2019 • “Collective Dynamics of Solitons in Superfluids,” Research highlight for prospective graduate students, Department of Physics, Cornell University, March 2017
WORK IN PROGRESS	<ul style="list-style-type: none"> • Dynamically induced first- and second-order phase transitions in a resonantly shaken optical lattice (with Ulrich Schneider’s experimental group and Nigel Cooper) • Pulsed generation of multiple nonlocal Bell pairs (with Nigel Cooper and Stefan Kuhr) • Interferometric signatures of bosonic fractional quantum Hall states (with Nigel Cooper)
COLLABORATORS	Nigel Cooper, Erich Mueller, Ulrich Schneider, Andrew Daley, Jon Simon , Stefan Kuhr
PUBLIC ENGAGEMENT	<p>Newspaper articles and research highlights written for a general audience:</p> <ul style="list-style-type: none"> • Surprising nature of quantum solitary waves revealed • Researchers pave an enlightened path to anyons and quantum computation • A quantum ear • Hidden symmetry could be key to more robust quantum systems, researchers find <p>Non-technical summary and illustrations of research on personal website: shovandutta.org</p>

Lunchtime seminars at Darwin college for non-physicists – see Talks above

Short presentations on YouTube: <https://tinyurl.com/yyqmc2d4>

TEACHING
EXPERIENCE

- Head of class and co-examiner for **TP2: Advanced Quantum Mech.**, Cambridge, Lent 2020
- Supervisor for **Part IB Physics A: 2nd year Natural Sciences**, Cambridge, 2018-19
Experimental methods, Waves, Quantum physics, Condensed matter physics
- Teaching assistant for a number of undergraduate courses at Cornell University, 2012-16
Electromagnetism, Mechanics & special relativity, and courses for non-physics majors
Details and student evaluations available at shovandutta.org/teaching/

UNPUBLISHED
RESEARCH

- Understanding nucleation of superfluid B phase in ^3He , 2018 (with E. Mueller and J. Parpia)
- Thermalisation in a quasi-one-dimensional quantum gas, 2015 [[manuscript](#)] [[slides](#)]
- Photoemission from thin semiconductor films, 2012 (with C. Bose and M. Bose)
- Liquid-gas phase transition of cold nuclear matter, 2011 (with S. Ray and J. Shamanna)

EDITORIAL

Regular referee for PRL (since 2017), PRA (since 2018), and PRB (since 2019)

ADMINISTRATIVE

Co-organised the **Cavendish Quantum Colloquia**, 2018-19, University of Cambridge
Group representative within the multi-university **DesOEq** programme grant, 2020