

CONTACT INFORMATION	<p>University of Cambridge Cavendish Laboratory, TCM Group 19 JJ Thomson Avenue Cambridge, CB3 0HE, UK</p>	<p>Website: https://shovandutta.org/ Email: sd632@cornell.edu, sd843@cam.ac.uk</p>
ACADEMIC POSITION	<p>Postdoctoral Research Associate Darwin College, Cambridge Supervisor: Prof. Nigel Cooper</p>	September 2018 - present
EDUCATION	<p>Cornell University, Ithaca, USA Ph.D. in Physics, 2018 M.S. in Physics, 2015 Advisor: Prof. Erich Mueller Dissertation: Collective Phenomena in Quantum Gases</p> <p>Jadavpur University, Kolkata, India B.E. in Electronics and Tele-Communication Engineering 1st class with Honours, CGPA: 9.42/10</p> <p>Howrah Zilla School, Howrah, India Passed Higher Secondary Exam in 2008 with 96.33% in Science</p>	<p>2012 - 2018</p> <p>2008 - 2012</p> <p>1998 - 2008</p>
AWARDS AND ACADEMIC ACHIEVEMENTS	<p>Postdoctoral Fellowship at Max Planck-Harvard Center for Quantum optics, 2018 (declined)</p> <p>DAMOP Travel Award from American Physical Society, 2017 and 2018</p> <p>Dr. V. Ramachandra Rao Summer Fellowship, Cornell University, 2013</p> <p>Hartmann Memorial Teaching Award, Cornell University, 2012-13</p> <p>Dr. Shyama Prasad Mukherjee (SPM) Fellowship from the Council of Scientific and Industrial Research (CSIR), India, 2012 (declined)</p> <p>1st all over India in CSIR National Eligibility Test (NET) in Physical Sciences, 2012, for award of Junior Research Fellowships and eligibility for lectureship</p> <p>1st all over India in Joint Entrance Screening Test (JEST) in Physics, 2012, organized by 24 premier research institutes in India</p> <p>Within top 50 in Physics Nationwide Entrance Examination (TIFR GS), 2012, organized by the Tata Institute of Fundamental Research, India</p> <p>1st all over India in Graduate Aptitude Test in Engineering (GATE) Physics 2011, organized by Indian Institute of Science (IISc) and the Indian Institutes of Technology (IITs)</p> <p>Best paper award in National Students Paper and Circuit Design Contest (NSPCDC) 2011, organized by IEEE Jadavpur University Students' Branch and IEEE Calcutta Section</p> <p>Late Supriya Basu Scholarship from Jadavpur University Alumni Association (Mumbai Branch), 2010, for securing highest grade in all engineering departments</p> <p>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</p>	

Within top 50 (among $\sim 4 \times 10^5$ students) in the West Bengal Higher Secondary Examination, 2008 – Ministry of Human Resource Development (MHRD) Scholarship, Government of India

2nd in the Achievement-cum-Diagnostic Test in Mathematics (ADTM) 2007, organized by the Centre for Pedagogical Studies in Mathematics, West Bengal

RESEARCH OVERVIEW

My research is focused on understanding the **physics of interacting quantum gases** by theoretical modeling and numerical simulation. This is in part motivated by a remarkable growth of versatile experimental platforms for trapping and manipulating systems of atoms and photons. I have studied **exotic phases of matter**, **collective excitations**, and **quantum dynamics** of such systems. My recent work has explored novel **out-of-equilibrium** properties arising in the presence of **dissipation** and/or periodic **driving in open quantum systems**, and how they can be probed in experiments. I am also actively involved in developing widely applicable **numerical techniques**, such as **DMRG** for continuum systems.

PUBLICATIONS

[Summary with illustrations available at shovandutta.org/research/#publications]

7. **Shovan Dutta** and Nigel R. Cooper, “Critical Response of a Quantum van der Pol Oscillator,” *Phys. Rev. Lett.* **123**, 250401 (2019) [pdf] [supplement] [arXiv] [slides] [poster].
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] [supplement] [arXiv] [news story] [slides] [poster] [animation].
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].
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] [news story] [slides] [poster].
3. **Shovan Dutta** and Erich J. Mueller, “Dimensional crossover in a spin-imbalanced Fermi gas,” *Phys. Rev. A* **94**, 063627 (2016) [pdf] [arXiv] [slides].
2. **Shovan Dutta** and Erich J. Mueller, “Kinetics of Bose-Einstein condensation in a dimple potential,” *Phys. Rev. A* **91**, 013601 (2015) [pdf] [arXiv] [slides].
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] [slides].

E-PRINTS

[Summary with illustrations available at shovandutta.org/research/#eprints]

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” [best paper in the National Students Paper and Circuit Design Contest (NSPCDC) 2011]. Available at http://ewh.ieee.org/sb/calcutta/jadavpur/Papers/Circuit_Model_for_Bogdanov-Takens_Bifurcation.pdf.

WORK IN
PROGRESS

[Summary with illustrations available at shovandutta.org/research/#workinprogress]

3. Strongly interacting bosons with local source and sink [with Nigel Cooper].
2. Dynamically induced phase transitions in a resonantly shaken lattice [with [Ulrich Schneider](#) and Nigel Cooper]
1. Matrix product states (DMRG) for continuous 1D systems [with Erich Mueller (Cornell), Anton Buyskikh (Riverlane), and [Andrew Daley](#) (Strathclyde)].

TALKS

2019

- “Critical Response of a Quantum van der Pol Oscillator,” Centre for Condensed Matter Theory (CCMT) Seminar, Indian Institute of Science (IISc), December 11, 2019.
- “Critical Response of a Quantum van der Pol Oscillator,” [Joint DesOEq-QSUM meeting](#), University of Oxford, September 16, 2019.
- “Critical Response of a Quantum van der Pol Oscillator,” Collective Phenomena Group Meeting ([CPGM](#)) talk, University of Cambridge, July 16, 2019.
- “Critical Response of a Quantum van der Pol Oscillator,” Condensed Matter and Quantum Materials ([CMQM](#)) Conference, University of St Andrews, July 03, 2019.
- “Paving an enlightened path to anyons and quantum computation,” [Science Lunchtime Seminar](#), Darwin College, Cambridge, April 25, 2019.
- “Creating and Braiding Anyons in an Optical Cavity,” Department of Physics Seminar, University of Strathclyde, January 2019.

2018

- “Creating and Braiding Anyons in an Optical Cavity,” Collective Phenomena Group Meeting ([CPGM](#)) talk, University of Cambridge, October 10, 2018.
- “Creating and Braiding Anyons in an Optical Cavity,” Public talk (thesis defense), Department of Physics, Cornell University, April 27, 2018.

2017

- “Collective Dynamics of Solitons in Superfluids,” Research highlight for prospective graduate students, Department of Physics, Cornell University, March 27, 2017.

POSTERS

2019

- “Critical Response of a Quantum van der Pol Oscillator,” Bose-Einstein Condensation ([BEC](#)) 2019, Sant Feliu de Guixols, Spain, September 09, 2019.
- “Creating and Braiding Anyons in an Optical Cavity,” MPIPKS International Workshop on [Synthetic Topological Matter](#), Dresden, Germany, May 21, 2019.
- “Critical Response of a Quantum van der Pol Oscillator,” [DesOEq](#) (Designing Out-of-Equilibrium Quantum systems) Review Meeting, Glasgow, Scotland, March 14, 2019.

2018

- “Creating and Braiding Anyons in an Optical Cavity,” DesOEq Annual Meeting & DOQS Workshop, Glasgow, Scotland, October 15, 2018.
- “Creating and Braiding Anyons in an Optical Cavity,” 49th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics ([DAMOP](#)), Fort Lauderdale, Florida, May 30, 2018.

- “Creating and Braiding Anyons in an Optical Cavity,” Cornell Center for Materials Research (CCMR) Symposium on Advances in Photonics and Quantum Optics, Ithaca, New York, May 23, 2018.

2017

- “Creating and Braiding Anyons in an Optical Cavity,” ARO/AFOSR Quantum Matter MURI Program Review, Gaithersburg, Maryland, October 12, 2017.
- “Creating and Braiding Anyons in an Optical Cavity,” ITAMP workshop on [Many-Body Cavity QED](#), Boston, Massachusetts, October 10, 2017.
- “Collective Modes of a Soliton Train in a Fermi Superfluid,” 48th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), Sacramento, California, June 6, 2017.

2016

- “Collective Modes of a Soliton Train in a Fermi Superfluid,” ARO/AFOSR Quantum Matter MURI Program Review, Chicago, Illinois, September 27, 2016.

UNPUBLISHED WORK

[Summary with illustrations available at shovandutta.org/research/#unpublished]

3. Understanding the nucleation of superfluid B phase in ^3He as it is supercooled below the A-B transition temperature (2018) [with Erich Mueller and Jeevak Parpia] – unresolved.
2. 1D-to-3D crossover in a spin-imbalanced Fermi gas in an array of coupled tubes (2016) [with Erich Mueller] – extension of our [work](#) on dimensional crossover in a single tube.
1. Thermalization in a quasi-one-dimensional quantum gas (2015) [with Erich Mueller and Mukund Vengalattore] [[manuscript](#)] [[slides](#)].

UNDERGRAD RESEARCH EXPERIENCE

[More details available at shovandutta.org/research/#undergradresearch]

- Bifurcation in classical dynamical systems – see [eprints](#) above.
- Random walks modeling anomalous diffusion – see [eprint](#) above.
- Photoemission from thin semiconductor films [with [Chayanika Bose](#) and Manas Bose]
- [PT-symmetric](#) quantum mechanics [with Subhankar Ray]
- Liquid-gas phase transition of cold nuclear matter [with Subhankar Ray and Jaya Shamanna]

REFEREE FOR

Phys. Rev. Lett. (since 2017), Phys. Rev. A (since 2018), Phys. Rev. B (since 2019)

ADMINISTRATIVE

Co-organizer for the [Cavendish Quantum Colloquia](#) 2018-19, University of Cambridge.

TEACHING EXPERIENCE

2018

- Supervisor for [Part IB Physics A](#): 2nd year Natural Sciences, Cambridge, 2018-19
Exp. methods, Waves, Quantum physics, Condensed matter physics
Held weekly supervisions for a small group of students

2016

- TA for [PHYS 3327](#): Advanced Electricity and Magnetism, Cornell, Fall 2016
Held discussion section, designed numerical problems, taught Mathematica
Student evaluations: find [here](#)

- TA for [PHYS 2216](#): Introduction to Special Relativity, Cornell, Fall 2016
Designed concepts-based [quiz problems](#), graded
- TA for [PHYS 1116](#): Mechanics and Special Relativity, Cornell, Spring 2016
Held discussion and lab sections, prepared [quiz problems](#), graded
Student evaluations: [find here](#)

2015

- TA for [PHYS 2213](#): Electromagnetism (for engg. majors), Cornell, Fall 2015
Held discussion and lab sections, managed Q&A forum on [Piazza](#),
designed new demonstrations (with Jenny Wurster), graded
Student evaluations: [find here](#)
- TA for [PHYS 1203](#): Physics of Heaven and Earth (non-sci. majors), Cornell, Spring 2015
Held discussion section, graded
Student evaluations: [find here](#)

2014

- TA for [PHYS 2208](#): Fundamentals of Physics II (for pre-meds), Cornell, Spring 2014
Held discussion sections, prepared [quiz problems](#), graded
Student evaluations: [find here](#)

2013

- TA for [PHYS 2208](#): Fundamentals of Physics II (for pre-meds), Cornell, Spring 2013
Held discussion sections, prepared quizzes, graded
Student evaluations: [find here](#)

2012

- TA for [PHYS 2207](#): Fundamentals of Physics I (for pre-meds), Cornell, Fall 2012
Held discussion and lab sections, prepared quizzes, graded
Student evaluations: [find here](#)

PROGRAMMING	Mathematica, ITensor (C++), SSH, HTML
LANGUAGES	English (fluent), Bengali (native), Hindi (working knowledge), Sanskrit (beginner)
EXTRA-CURRICULAR ACTIVITIES	Music – learned Indian ragas and Bengali music for several years (won competitions!) Reading non-fiction, watching documentaries, movies, interviews, and comedy Walking through woods, boating on lakes Playing cricket, tennis, and the harmonium