1. Personal Information

Dr. Kazi Rajibul Islam
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Citizen of India

2. Research Interests

- Quantum computation with laser-cooled trapped ions.
- Experimental quantum many-body physics, especially quantum simulation of frustrated spin models with trapped ions.
- Use of holography and high resolution microscopy to manipulate quantum many-body systems.

3. Education

- Doctor of Philosophy (Ph.D.) in Physics, University of Maryland, College Park, USA (2012)
  Dissertation : Quantum Simulation of Interacting Spin Models with Trapped Ions
  Advisor : Chris Monroe, Joint Quantum Institute

- Master of Science (M.Sc.) in Physics, Tata Institute of Fundamental Research, Mumbai, India (2007)
  Thesis : Modulated Phases in Systems with Competing Interactions.
  Advisor : Mustansir Barma, Department of Theoretical Physics

- Bachelor of Science (B.Sc.) in Physics, Jadavpur University, Kolkata, India (2005)

4. Recognitions

1. Awarded Early Researcher Award, Ontario (2019)

2. Distinguished Dissertation Award, University of Maryland (2013).
   Four awards are given each year, one in each of these broad disciplinary areas: a. Mathematics, Physical Sciences, and Engineering, b. Social Sciences, c.

Humanities and Fine Arts, and d. Biological and Life Sciences. In 2013, a total of 625 students received PhD from the University of Maryland.

3. Best paper award, DARPA Optical Lattice Emulator (OLE) project (2011).
   The OLE project of the Defense Advanced Research Projects Agency (DARPA), USA was a multi-university initiative on quantum simulation with cold atomic platforms. About 18 institutions took part in this five-years initiative. I won one of three best paper awards given to experimentalists in 2011 for my publication in Nature Communications.

4. Honorable Mention, Ralph D. Myers 2007/2008 Teaching Assistant Award for Excellence in Teaching, University of Maryland (2007).
   Eight TAs were awarded in the Physics department for 2007-08.

5. Employment History

- Assistant Professor, Institute for Quantum Computing and Department of Physics and Astronomy, University of Waterloo (2016 -)
- Affiliate Faculty, Perimeter Institute for Theoretical Physics (2017-20)
- Postdoctoral Researcher, Department of Physics, Research Laboratory for Electronics and Center for Ultracold Atoms, Massachusetts Institute of Technology (MIT), Cambridge, MA (Vladan Vuletic group, 2015-16)
- Postdoctoral Fellow, Center for Ultracold Atoms, Harvard University, Cambridge, MA (Markus Greiner group, 2012-15)

6. Activities

6.1. Student/Postdoctoral Supervision

Postdoctoral Fellows
Dr. Fereshteh Rajabi (2017- , jointly with Perimeter Institute)
Dr. Roland Hablutzel (2018-)
Dr. Matt Day (2020 - , jointly with Prof. Crystal Senko)

Graduate Students
Chung-You Shih (2017-)
Nikhil Kotibhaskar (2017-)
Sainath Motlakunta (2018-)

Dr. Manas Sajjan (2018-)
Yi Hong Teoh (2019 - , co-supervised by Roger Melko)
Nikolay Videnov (2019 -)
Zewen Sun (2019 -)

Undergraduate Research Assistants
Tony Kappen (2017)
Kaleb Ruscitti (2017-18)
Nikolay Videnov (2017-18)
Ilango Maran (2017-18)
Louisa Huang (2017)
Jieren Deng (2017)
Yi Hong Teoh (2018 - 19)
Luyao Wang (2018)
Daniel Julien-Neitzert (2019)
Natasha Willis (2019)
Duale Omar (2019)
Joshua Da Costa (2019)
Thiago Bergamaschi (2019, visiting student from MIT)
Sarah Mayers (2019)
Richard Lewis Hahn (2019 - 20)
Michael Li (2019)
Niel Mistry (2019)
Xinci (Cindy) Yang (2019 – 20)
Austin Con (2020)
Michael Spinazze (2020)
Gaurav Tathed (2020)
Michael Veenstra (2020)
Rachel DiTomasso (2020)
Scott Hubele (2020)

6.2. Editorial Activities

1. Referee - *Science*
2. Referee - *Physical Review Letters*
3. Referee - *Physical Review X*
4. Referee - *New Journal of Physics*
5. Referee - *Nature Scientific Report*
6. Referee - *Physical Review C*

6.3. Teaching

1. PHYS 234 (Quantum Mechanics I), University of Waterloo, 2020 Winter
2. PHYS 393 (Physical Optics), University of Waterloo, 2020 Winter

3. PHYS 234 (Quantum Mechanics I), University of Waterloo, 2019 Winter
4. PHYS 256 (Geometrical and Physical Optics), University of Waterloo, 2018 Fall.
5. QIC750 (Implementation of Quantum Information, Graduate level course), Guest lecture, 2018 Winter.
6. PHYS 256 (Geometrical and Physical Optics), University of Waterloo, 2017 Fall.
7. Physics 15c (Wave phenomena laboratory course, assisting Prof. Markus Greiner), Harvard University, 2012 Fall.
8. PHYS 275 (Laboratory course on mechanics and heat), Teaching Assistant, University of Maryland, College Park, 2007 Fall.

6.4. Service

1. Member of the Science Faculty Council, University of Waterloo (2018 - current)
2. External Advisor, “Engagement, Retention and Innovation in Physics Instruction at University of Maryland Eastern Shore” program, HBCU-UP (National Science Foundation, USA, 2018-current).
3. Physics faculty hiring committee, Institute for Quantum Computing (2017)
4. Undergraduate Curriculum committee, Department of Physics, University of Waterloo (2017 - current)
5. PhD Committees
    1. 2018 - current, Shaeera Rabbanee Shuvra, Department of Electrical and Computer Engineering, University of Waterloo (PhD advisory committee, Internal external member)
    2. 2018 – Markus Hauru, Department of Physics and Astronomy and Perimeter Institute (PhD defense committee)
    3. 2017, Benjamin Wales, Department of Physics and Astronomy, University of Waterloo (PhD defense committee)
    4. 2018, Antonio Martinez, Department of Physics and Astronomy, University of Waterloo (PhD advisory committee)

6. **M.Sc. committees**
    1. 2017-19, Nikhil Kotibhaskar, Department of Physics and Astronomy, University of Waterloo
    2. 2017-19, Chung-You (Gilbert) Shih, Department of Physics and Astronomy, University of Waterloo
    3. 2017-19, Pei Jiang Low, Department of Physics and Astronomy, University of Waterloo
    4. 2018, Junan Lin, Department of Physics and Astronomy, University of Waterloo
    5. 2018, Cameron Vickers, Department of Physics and Astronomy, University of Waterloo
    6. 2018-19, Jeremy Kelly-Massicottee, Department of Physics and Astronomy, University of Waterloo
    7. 2019, Zhenghao (Andy) Ding, Department of Physics and Astronomy, University of Waterloo

8. 2018, Sainath Motlakunta, Department of Physics and Astronomy, University of Waterloo
9. 2019, Shayan Majidy, Department of Physics and Astronomy, University of Waterloo
10. 2018-20, Manas Sajjan, Department of Physics and Astronomy, University of Waterloo

6.5. Conference/workshop Organization

- Co-organized (with Dr. Guifre Vidal, Perimeter Institute) the Many-body states and dynamics workshop between Perimeter Institute of Theoretical Physics and Institute for Quantum Computing, Jun 7, 2018

- Co-organized (with Dr. Tim Hsieh, Perimeter Institute) the Many-body states and dynamics workshop between Perimeter Institute of Theoretical Physics and Institute for Quantum Computing, Jun 13, 2019

6.6. Public Outreach

1. Physics demonstrations and lab tours on Annual Maryland Day, Joint Quantum Institute and Department of Physics, University of Maryland (2008-12)
2. Science seminar and demonstration for high school students, West Bengal, India (2007- present)
3. Co-founder of bigyan.org.in – one of the largest online and peer-reviewed popular science platforms run by the worldwide researcher community in the Bengali language. Highlighted in the Indian national media – Times of India (Aug 11, 2014, Link), NDTV (Feb 27, 2017, Link).
4. 'Role model' for student participants to engage with practicing scientists, Grades 6-8, LAUNCH Waterloo (May 12, 2018)

7. Contributions

Summary

Citations : 3413
Number of peer-reviewed papers: 17
h-index: 14
(Google Scholar, 14 Aug, 2020)

- Papers published in high-impact factor journals: *Nature* (2), *Science* (2), *Nature Communications* (1), *Phys. Rev. Lett.* (4), *npj Quantum Information* (1)
- h-index = 13

- Convention on the order of authorship: The senior author (PI) is the last on the author's list. The first position on the authors' list is reserved for the author who took the most active role and made the most contribution in the research. Post-doctoral fellows, when they are not the lead author, are listed as the second to the last author. Publications with Prof. Greiner and Prof. Vuletic follow this convention.

7.1. Publications and Citations

7.1.1. Pre-print

1. "Programmable Quantum Simulations of Spin Systems with Trapped Ions, C. Monroe, W. C. Campbell, L.-M. Duan, Z.-X. Gong, A. V. Gorshkov, P. Hess, R. Islam, K. Kim, G. Pagano, P. Richerme, C. Senko, and N. Y. Yao *arxiv:1912.07845*

7.1.2. Peer-reviewed journals

1. Machine learning design of a trapped-ion quantum spin simulator,
   Yi Hong Teoh, Marina Drygala, Roger G. Melko, Rajibul Islam
   Quantum Science and Technology 5, 024001 (2020)

2. Dynamic Hamiltonian engineering of 2D rectangular lattices in a one-dimensional ion chain,
   Fereshteh Rajabi, Sainath Motlakunta, Chung-You Shih, Nikhil Kotibhaskar, Qudsia Quraishi, Ashok Ajoy, and Rajibul Islam
   npj Quantum Information 5:32 (2019)

3. Single-atom heat machines enabled by energy quantization,
   David Gelbwaser-Klimovsky, Alexei Bylinskii, Dorian Gangloff, Rajibul Islam, Alan Aspuru-Guzik, and Vladan Vuletic,
   Phys. Rev. Lett. **120**, 170601 (2018)

4. Multislip friction with a single ion,
   Ian Counts, Dorian Gangloff, Alexei Bylinskii, Joonseok Hur, Rajibul Islam, Vladan Vuletic, *Phys. Rev. Lett.* **119**, 043601 (2017)

5. Ultra-precise holographic beam shaping for microscopic quantum control,
   P. Zupancic, P. M. Preiss, R. Ma, A. Lukin, M. E. Tai, M. N. Rispoli, R. Islam, M. Greiner,
   Optics Express Vol. **24**, Issue 13, pp. 13881-13893 (2016)

6. Measuring entanglement entropy in a quantum many-body system,
   Rajibul Islam, Ruichao Ma, Philipp Preiss, M. Eric Tai, Alexander Lukin, Matthew Rispoli, and Markus Greiner,

Nature **528**, 77 (2015). [featured in Nature “News and Views"]

7. Strongly Correlated Quantum Walks in Optical Lattices,
   Philipp M. Preiss, Ruichao Ma, M. Eric Tai, Alexander Lukin, Matthew Rispoli, Philip Zupancic, Yoav Lahini, Rajibul Islam, and Markus Greiner.
   Science **347**, 1229 (2015). [featured in “Science Insights"]

8. Beatnote stabilization of mode-locked lasers for quantum information processing,
   R. Islam, W. C. Campbell, T. Choi, S. Clark, C. W. S. Conover, S. Debnath, E. E. Edwards, B. Fields, D. Hayes, D. Hucul, K. G. Johnson, S. Korenblit, A. Lee, K. Lee, T. A. Manning, D. N. Matsukevich, J. Mizrahi, Q. Quraishi, C. Senko, J. Smith and C. Monroe,
   Optics Letters Vol. **39**, No. 11 (2014).

9. Quantum Catalysis of Magnetic Phase Transitions in a Quantum Simulator,
   P. Richerme, C. Senko, S. Korenblit, J. Smith, A. Lee, R. Islam, W. C. Campbell, and C. Monroe,
   Phys. Rev. Lett. **111**, 100506 (2013).

10. Emergence and Frustration of Magnetic Order with Variable-Range Interactions in a Trapped Ion Quantum Simulator,
    R. Islam, C. Senko, W. C. Campbell, S. Korenblit, J. Smith, A. Lee, E. E. Edwards, C.-C. J. Wang, J. K. Freericks, and C. Monroe,
    Science **340**, 583 (2013).

11. Quantum Simulation of Spin Models on an Arbitrary Lattice with Trapped Ions,
    S. Korenblit, D. Kafri, W. C. Campbell, R. Islam, E. E. Edwards, Z.-X. Gong, G.-D.Lin, L.-M. Duan, J. Kim, K. Kim, and C. Monroe,
    New J. Phys. **14** 095024 (2012).

12. Quantum Simulation of the Transverse Ising Model with Trapped Ions,
    K. Kim, S. Korenblit, R. Islam, E. E. Edwards, M.-S. Chang, C. Noh, H. Carmichael, G.-D.Lin, L.-M. Duan, C.-C. Joseph Wang, J. K. Freericks, and C. Monroe,
    New J. Phys. **13**, 105003 (2011).

13. Onset of a Quantum Phase Transition with a Trapped Ion Quantum Simulator,
    R. Islam, E. E. Edwards, K. Kim, S. Korenblit, C. Noh, H. Carmichael, G.-D.Lin, L.-M. Duan, C.-C. Wang, J. K. Freericks and C. Monroe,
    Nature Communications **2**:377 (2011).

14. Quantum Simulation and Phase Diagram of the Transverse Field Ising Model with Three Atomic Spins,
    E. E. Edwards, S. Korenblit, K. Kim, R. Islam, M.-S. Chang, J. K. Freericks, G.-D. Lin, L.-M. Duan, and C. Monroe,

Phys. Rev. B (Rapid Communications) **82**, 060412 (2010).

15. Quantum simulation of frustrated Ising spins with trapped ions, K. Kim, M.-S. Chang, S. Korenblit, R. Islam, E. E. Edwards, J. K. Freericks, G.-D. Lin, L.-M. Duan, and C. Monroe,
Nature **465**, 590 (2010). [featured in Nature “News and Views"]

16. Entanglement and Tunable Spin-Spin Couplings between Trapped Ions Using Multiple Transverse Modes,
K. Kim, M.-S. Chang, R. Islam, S. Korenblit, L.-M. Duan, and C. Monroe, *Phys. Rev. Lett.* **103**, 120502 (2009).

17. Large Scale Quantum Computation in an Anharmonic Linear Ion Trap,
G.-D. Lin, S.-L. Zhu, R. Islam, K. Kim, M.-S. Chang, S. Korenblit, C. Monroe, and L.-M. Duan, *Europhys. Lett.* **86**, 60004 (2009).

7.1.3. Conference proceedings

1. Quantum Networks with Atoms and Photons,
C Monroe, W Campbell, C Cao, T Choi, S Clark, S Debnath, C Figgatt, D Hayes, D Hucul, V Inlek, R Islam, S Korenblit, K Johnson, A Manning, J Mizrahi, B Neyenhuis, A Lee, P Richerme, C Senko, J Smith and K Wright.
J. Phys. Conf. Ser. **467**, 012008 (2013).

2. Quantum simulation of spin models with trapped ions,
C Monroe, WC Campbell, EE Edwards, R Islam, D Kafri, S Korenblit, A Lee, P Richerme, C Senko, J Smith
Proceedings of the International School of Physics ‘Enrico Fermi’ Course **189**, 169-187 (2015)

7.2. Invited lectures and presentations

1. Simulating the quantum world with laser-cooled trapped ions, (Online) P. K. College, Contai, India (11 July, 2020)

2. Simulating the quantum world with laser-cooled trapped ions, (Online) IIT Gandhinagar, India (19 Jun, 2020)

3. Programmable quantum simulation of fully-connected spin models using trapped ions, (Online) Condensed Matter and Dynamics Seminar, University of Toronto (1 Jun, 2020)

4. Simulating the quantum world with laser-cooled trapped ions, Online talk, Society of Physics Students, Lawrence Technological University, USA (06

May, 2020)

5. Quantum simulation of 2D spin models in a linear chain of trapped ions, TQT-UCSB Quantum Materials Workshop, Santa Barbara, USA (Feb 20, 2020)

6. Quantum Simulation with Trapped Ions - QANSAS 2019, Dayalbagh Educational Institute, Agra, India (Nov 12, 2019)

7. Quantum simulation of spin models in arbitrary spatial dimensions using a linear chain of ions – North American Conference on Trapped Ions (NACTI), University of Maryland, College Park, USA (July 22, 2019)

8. Quantum simulation of 2D and 3D spin models in a linear chain of ions - Many-body states and Dynamics workshop, Perimeter Institute, Waterloo (Jun 6, 2019)

9. Quantum simulation of 2D and 3D spin systems in a linear chain of trapped ions – Canadian Association for Physicists (CAP) congress, Simon Fraser University, BC (Jun 6, 2019)

10. Quantum simulation of 2D spin models in a linear chain of trapped ions – Center for Quantum Information and Control, University of New Mexico (May 2, 2019)
11. Dynamical engineering of spin-spin interaction graphs in a trapped ion quantum simulator – University of Strathclyde, Glasgow (Nov 12, 2018)

12. Dynamical engineering of spin-spin interaction graphs in a trapped ion quantum simulator - Kavli Institute of Theoretical Physics, UCSB, Santa Barbara (Experimentalist of the week, Dynamics of Quantum Information program, Aug 22, 2018)

13. Simulating the quantum world with trapped ions – Physics colloquium, Presidency University, Kolkata (July 30, 2018)

14. Simulating programmable frustrated spin systems with a trapped ion quantum simulator - Washington University, St. Louis (April 9, 2018)

15. Quantum simulation with trapped ions – McMaster University, Ontario (Feb 7, 2018)

16. Quantum Simulation with Trapped Ions, and Measuring entanglement in synthetic quantum systems (two lectures) - Theory Winter School, National High Magnetic Field Laboratory, Tallahassee (Jan 8-12, 2018).

17. Quantum Information Processing with Trapped Ions - Indian Association for the Cultivation of Science, Kolkata (July 31, 2017)

18. Quantum simulation with laser-cooled trapped ions - Canadian Association of Physicists Congress 2017, Queen's University, Kingston, Ontario (May 30, 2017)

19. Many-body physics in a trapped ion quantum simulator - 4-Corners Southwest Ontario Condensed Matter Physics Symposium, Perimeter Institute for Theoretical Physics (May 25, 2017)

20. Quantum Simulation with Laser-cooled Trapped Ions - Colloquium, Perimeter Institute for Theoretical Physics (Feb 22, 2017)

21. Controlling quantum many-body systems at the level of a single particle, University of California, Berkeley (Feb 13, 2017)

22. Quantum simulation with trapped ions - RAC seminar, Institute for Quantum Computing, Waterloo (Nov 11, 2016)

23. Measuring entanglement in quantum many-body systems - iQuISe seminar, Massachusetts Institute of Technology (Sep 29, 2016)

24. Measuring entanglement entropy - Bose-Einstein Condensation conference, Salerno, Italy (Sep 2, 2016)

25. Measuring entanglement entropy - Indian Association for the Cultivation of Science, Kolkata (July 8, 2016)

26. Measuring entanglement entropy in a many-body system - California Institute of Technology (Mar 8, 2016)

27. Measuring entanglement entropy in a many-body system - Institute for Quantum Computing, University of Waterloo (Feb 29, 2016)

28. Measuring entanglement entropy - Atomic Physics Seminar, Yale University (Feb 29, 2016)

29. Measuring entanglement entropy in optical lattice systems - Quantum Innovators workshop, Institute for Quantum Computing, University of Waterloo (Oct 4, 2015)

30. Measuring Entanglement Entropy in Bose-Hubbard Systems - Conference on Quantum Information and Quantum Control, Fields Institute, University of

Toronto (Aug 17, 2015)

31. Entanglement detection by interfering quantum many-body twins - IQIM seminar, California Institute of Technology (Apr 17, 2015).

32. Entanglement detection by interfering quantum many-body twins - KITP, Santa Barbara (Apr 14, 2015).

33. Entanglement detection by interfering quantum many-body twins - ITAMP, Harvard University (Mar 27, 2015).

34. Assembling strongly correlated quantum systems atom by atom - Physics Department Colloquium, University of Southern California, Los Angeles (Feb 11, 2015).

35. Synthetic quantum matter under a microscope - Physics seminar, Colby College, ME (Sep 29, 2014).

36. Bottom-up assembly of strongly correlated many-body systems in a Quantum Gas Microscope - Gordon Research Seminar, Stonehill College, MA (Jul 27, 2014).

37. Synthetic quantum matter under a microscope - Random interactions seminar, Department of Theoretical Physics, Tata Institute of Fundamental Research, Mumbai (Jul 9, 2014)

38. Synthetic quantum matter under a microscope - TIFR Center for interdisciplinary Sciences, Hyderabad (Jul 10, 2014).

39. Bottom-up assembly of strongly correlated many-body systems in a cold atom quantum simulator - Harvard University (KIDS seminar), Cambridge, MA (Apr 1, 2014).

40. Quantum simulation of interacting many body systems with cold atoms – Physics colloquium, Harish-Chandra Research Institute, Allahabad (Jan 10, 2014).

41. Probing many body physics with cold atom quantum simulator - Topical discussion at ITAMP, Harvard University (May 16, 2013).

42. Probing many body physics with cold atom quantum simulators - Theory Physics colloquium, Tata Institute of Fundamental Research (TIFR), Mumbai (Feb 5, 2013)

43. Probing many body physics with cold atom quantum simulators - Indian Institute of Science and Education Research (IISER), Pune (Feb 6, 2013).

44. Quantum simulation of interacting spin models with trapped ions – Harvard University Center for Ultracold Atoms seminar (Postdoc triple feature), Cambridge, MA (Sep 25, 2012).

45. Quantum simulations of magnetism with large numbers of atomic ion spins - American Physical Society DAMOP meeting, Orange County, CA (Jun 5, 2012).

46. Quantum simulation of interacting spin systems using trapped ions –Atomic Physics seminar 290F, University of California, Berkeley, CA (Feb 29, 2012).

47. Quantum Simulation of interacting spin systems using trapped ions – James Franck Institute, University of Chicago, Chicago, IL (Feb 9, 2012).

48. Quantum Simulation of interacting spin systems using trapped ions – Harvard Quantum Optics Center prize postdoc finalist (Dec 15, 2011).

49. Adiabatic quantum simulation of spin Hamiltonians using ultracold trapped ions - Indian Association for the Cultivation of Science, Kolkata (Jan 31, 2011).

50. Phase transition in long range quantum Ising model simulated with trapped ions - Condensed Matter Theory Center seminar, University of Maryland, College Park, MD (Dec 14, 2010).

7.3. Interview and Media

- *New Scientist*, Jun 9, 2016 (Scientific commentary in the article titled “Record number of ions get entangled together in a quantum trap”)
- *Phys.org*, Dec 3, 2015 (reporting on our publication in *Nature*)
  “A way to study entanglement entropy between multi-body systems”