Quantum Computing

Sowmitra Das

Some Videos

- Quantum Computers Explained – Limits of Human Technology
  (Courtesy of: **Kurzgesagt - In a Nutshell**)
- Quantum Computers, Explained With Quantum Physics
  (Courtesy of: **Quanta Magazine**)
- The Map of Quantum Computing
  (Courtesy of: **Domain of Science**)

Key Ideas

- **Superposition** (Compute in "Parallel")
  Used in **Quantum Algorithms**

- Measurement **Collapse**
  Used in **Quantum Cryptography**

- **Entanglement** (Non-Local Correlations)
  Used in **Quantum Communication**

Key Applications

- **Quantum Algorithms** - Exponential/Polynomial Speed-ups
  Integer Factoring, Quantum Search, Hamiltonian Simulation

- **Quantum Cryptography** - Provable (unbreakable) Security
  Quantum Key Distribution - BB84, E91

- **Quantum Communication** - Exotic Protocols
  Quantum Teleportation, Superdense Coding

Other Areas - Quantum Information Sciences

- Quantum Machine Learning
- Quantum Error Correction
- Quantum Complexity Theory
- Quantum Information Theory
- Quantum Internet
- Quantum Sensing
- Relativistic Quantum Information
- Quantum Thermodynamics
- Quantum Foundations
- Quantum Hardware
  (Superconductors, Atoms, Photons, Ions, Diamonds…)

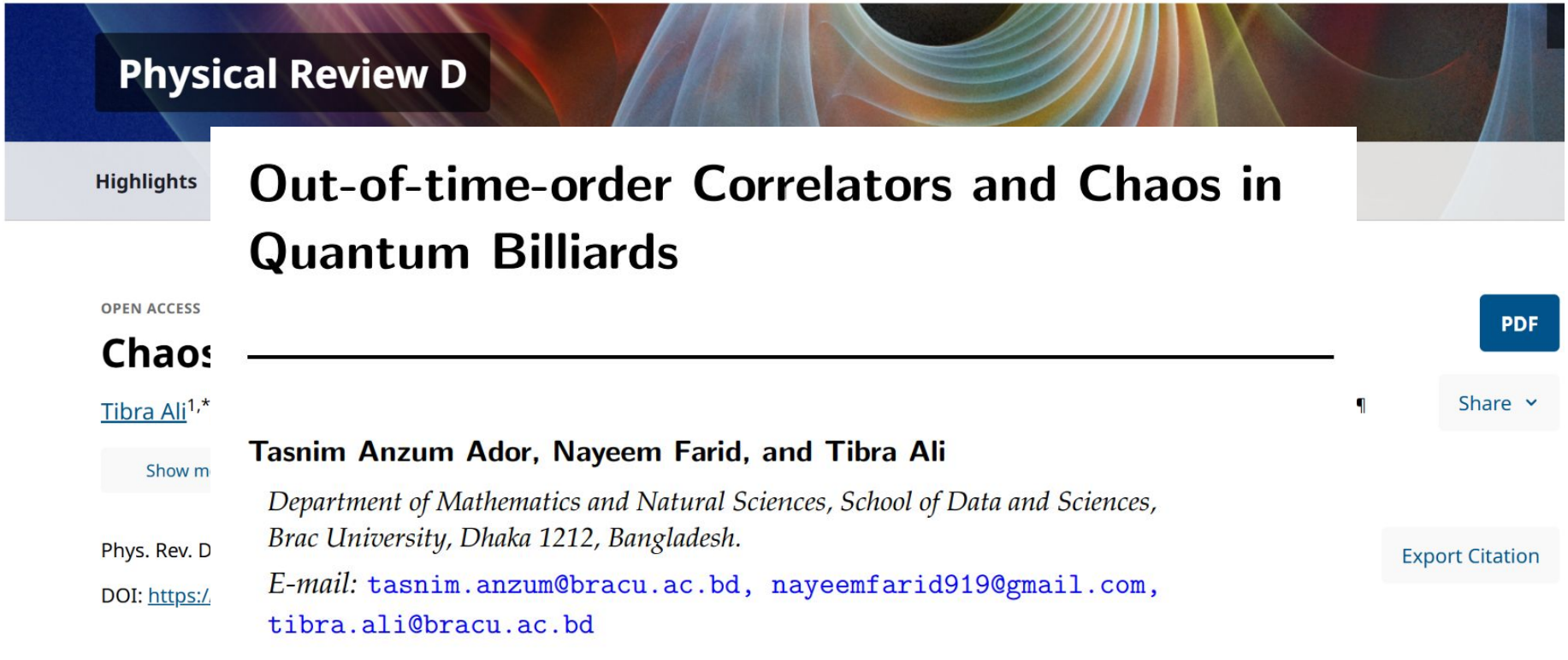
People

- **Sowmitra Das** - Quantum Error Correction, Information Theory
- **Shadman Shahriar** - Quantum Algorithms
- **Nafis Faisal** - Quantum Communication
- **Mahbub Majumdar** - Quantum Gravity, Information Theory
- **Tibra Ali** - Quantum Gravity, Complexity, Chaos
- **Nazmun Falgunee Moon** - Quantum Foundations

Past People:

- Jishnu Mahmud - University of Tennessee, Knoxville
- Syed Emad Uddin Shubha
- Shahnewaz Ahmed
- Wasif Ahmed
- Rabiul Hasan - University of Helsinki (Netherlands)
- Niloy Deb Roy - University of Indiana (USA)

Our Works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Highlights
Out-of-time-order Correlators and Chaos in Quantum Billiards
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Chaos
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Supervised Thesis

- **Quantum Error Correction** Using **Quantum Convolutional Neural Network**
- A **Quantum Algorithm** for pairwise sequence alignment
- Hybrid **Quantum-Classical Learning** for Image Classification

Other (ongoing) Topics -

- **Fault-tolerant Quantum Error Correction**
- **Continuous Variable** Quantum Computing
- Exploring expressivity of **Variational Quantum Ansatzes**
- Training **Quantum Neural Networks**
- Black Hole **Information Paradox**

How to Get Started

- You need to be comfortable doing **Math**
- **Linear Algebra!!!**
- (CSE481) Quantum Computing I
- (CSE482) Quantum Computing II
- (CSE483) Quantum Computing III
- **Only** undergraduate QC courses in Bangladesh
- All recorded lectures on YouTube (রাফখাতা)!

- Weekly Seminars (currently off 😞😞😞)
  Hope to restart soon…

Thank You!

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