

ARITRA DAS

“But I have promises to keep, and miles to go before I sleep”

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PERSONAL DETAILS

Gender Male
Date of Birth 28/10/1998
Place of Birth Kolkata, India

Passport No. P0218154
Place of Issue Kolkata
Expiry Date 06/07/2026

Languages English (C2), Bengali (C2),
Hindi (B1), French (A2)

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West Bengal, India

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Canberra City, ACT 2601, Australia

Academic Profiles [ORCID](#), [ResearchGate](#), [LinkedIn](#)



EDUCATION

Australian National University

Ph.D. Candidate
Department of Quantum Science,
Research School of Physics

December 2021 — ongoing
Supervisor: Ping Koy Lam
ANU Quantum Optics Group

Indian Institute of Technology Kanpur

Four-year Bachelor of Science (BS)
Department of Physics

July 2016 — July 2020
CPI: 8.7/10

Semester	SPI	CPI
1	8.4	8.4
2	9.2	8.8
3	7.8	8.4
4	9.2	8.6
5	8.4	8.6
6	9.2	8.7
7	8.3	8.6
8	9.0	8.7

The Future Foundation School

Council for the Indian School Certificate Examinations
Science Stream

2000 — 2016

Standard	Examination	Year Taken	Score
10th	Indian Certificate of Secondary Education	2014	96.8%
12th	Indian School Certificate	2016	97%

TEST SCORES

GRE General

6th September, 2019

Quantitative Reasoning: 170/170, Verbal Reasoning: 163/170, Analytical Writing: 4/6.

TOEFL

12th October, 2019

Reading: 30/30, Listening: 29/30, Speaking: 30/30, Writing: 27/30.

GRE Subject

26th October, 2019

Physics: 960/990.

RESEARCH INTERNSHIPS

Institute for Quantum Science and Technology, University of Calgary *Calgary, Alberta, Canada*

May — July, 2019

[Link to abstract](#)

- Worked under Prof. Barry Sanders, Director, Institute for Quantum Science and Technology, University of Calgary.
- Studied the quantum phase estimation algorithm, its iterative and Kitaev-improved versions, and explored the possibility of their in a Quantum Fully Homomorphic Encryption setting.
- Studied the delegation of Shor's factorization of 15 in a blind quantum computation scenario.
- Developed circuits for the blind quantum factorization of 21, with the modular exponentiation compiled for base 4. This results in an odd-period circuit, requiring non-Clifford elements including Toffoli gates, the design of which represents a significant advance over the previous blind quantum factorization of 15.
- Verified the designed circuits via both simulation and experiments using IBM's Qiskit software and cloud-based quantum computers.
- This internship was fully funded by the Shastri Indo-Canadian Institute, under the Shastri Research Student Fellowship program.

Indian Association for the Cultivation Of Science

Kolkata, West Bengal, India

May — July, 2018

[Link to article](#)

- Worked under Emeritus Prof. Jayanta K. Bhattacharjee, ex-Director of Harish-Chandra Research Institute, Allahabad.
- Investigated the convective instabilities in driven active matter and established connections with RB instabilities in the Lorenz model.
- Analyzed the fluid motion above instabilities by modeling them as Lorenz-like equations and studied the dynamical behavior close to the critical points.
- Studied the existence of Hopf bifurcations and limit cycles in the parameter space.
- Verified theoretical predictions with numerical simulations at various parameter values.

Indian Statistical Institute

Kolkata, West Bengal, India

June — July, 2017

[Link to article](#)

- Worked in a team of two, under Prof. Guruprasad Kar, Physics and Applied Mathematics Unit, ISI Kolkata.
- Studied literature on links between Bayesian game theory and quantum nonlocality.
- Explicitly constructed a Bayesian game where mixed-entangled advice yields higher payoffs than the maximum possible classically, per player.
- Employed the concept of a social welfare solution, or pseudo pareto correlated equilibrium, to find a mixed-entangled state that acts as quantum social welfare advice in this game.

- Leveraged a relatively novel two-party, two-outcome, three-action nonlocal inequality, I–3322, that distinguishes classical strategies from mixed quantum strategies unlike the CHSH inequality.

CONFERENCES AND WORKSHOPS ATTENDED

CQC2T Center Workshop

Hobart, Tasmania, Australia

May 30 — June 2, 2022

[Center Homepage](#)

- Attended talks on quantum error correction, quantum memories, quantum computation, etc. by eminent quantum physicists and computer scientists from across Australian universities
- Engaged in stimulating discussions with participating researchers

Quantum Australia

Sydney, New South Wales, Australia

Feb 23 — Feb 25, 2022

[Conference Website](#)

- Attended talks by industry professionals from Microsoft, IBM, PsiQuantum, Quintessence Labs, Silicon Quantum Computing, etc., on implementing quantum software and fabricating quantum hardware
- Interacted with other early-career researchers

XXX IUPAP Conference on Computational Physics 2018

University of California, Davis, California, United States of America

July 29 — August 2, 2018

[Conference Website](#)

- Delivered an oral presentation of the article “Social Advantage with Mixed Entangled States”.
- Attended talks by eminent physicists from Microsoft, IBM, etc., on challenges faced in implementing quantum algorithms, in particular quantum Monte Carlo algorithms.
- Interacted and engaged in stimulating discussions with the organizing faculty and other participants.
- Article published as conference proceedings in JPCS IOP Conference Series.

Workshop on Quantum Computation and Information Theory

Indian Statistical Institute, Kolkata, West Bengal, India

May — June 2017

[Organiser Homepage](#)

- Introduced to the field of quantum computing—qubits, gates, circuits, protocols like quantum teleportation, superdense coding, etc. and algorithms like Deutsch-Jozsa, Grover’s search, etc.
- Studied quantum entanglement, pure- and mixed-entangled states, and quantifiers of entanglement like entanglement witnesses, entanglement monotones and the Peres–Horodecki criterion.
- Explored Bell States, Werner States, GHZ or cat states, Bell inequalities, the CHSH inequality and studied general nonlocal inequalities as faces of a classical polytope
- Introduced to the field of quantum information—classical noise and Markov processes, quantum channels, quantum noise, distance measures or fidelity, Shannon entropy and Von Neumann entropy, Holevo bound, data compression, Shannon’s coding theorems, private key cryptography and quantum key distribution protocols.

OTHER PROJECTS

Ordered & Chaotic Dynamics of a 3-DOF Pendulum System

Undergraduate Research Project (PHY556A & PHY557A)

August 2019 — March 2021

[Link to article](#)

- Mentored by Prof. Sagar Chakraborty, Department of Physics, IITK.
- Extensively studied literature on the dynamics of non-integrable Hamiltonian systems.
- Analyzed the regular dynamics of the spring–mass–spherical–pendulum using canonical & Birkhoff-Gustavson perturbation theory.
- Used two-timing to explain the precessional dynamics and energy exchange between modes.
- Employed fast Lyapunov indicators to demonstrate the emergence of chaos from resonance.

Communication & Computation on Quantum Access Structures

March — April, 2019

Quantum Computing Course Project (CS682A)

[Project Report](#)

- Mentored by Prof. Rajat Mittal, Department of Computer Science, IITK.
- Studied literature on quantum access structures, threshold structures, maximal structures.
- Studied literature on quantum error correction, stabilizer codes and CSS codes.
- Closely studied “[Computing on Quantum Shared Secrets for General Quantum Access Structures](#)”.
- Verified the correctness of the inductive algorithm to construct arbitrary access structures.

Diffraction Effects in a Mechanically Chopped Laser Pulse

October — November, 2018

Modern Physics Laboratory Course Project (PHY315A)

[Project Report](#)

- Mentored by Prof. Krishnacharya Khare, Department of Physics, IITK.
- Detected periodic intensity undulations at edges of a mechanically chopped laser pulse using photodetectors.
- Captured 1-dimensional diffraction profile from straight-edge of the chopper in time domain.
- Accurately measured the wavelength of the laser beam from the undulation frequency.
- Experimentally verified results of “[Diffraction effects in mechanically chopped laser pulses](#)”.

Solving Boundary Value Problems using Green’s Method

May — July 2018

Saha Institute of Nuclear Physics, Kolkata, West Bengal

- Introduced to Green’s functions and their use in solving inhomogeneous boundary-value problems.
- Studied applications of this method to problems in classical electrodynamics and quantum mechanics.

LIST OF PUBLICATIONS

Published:

1. “Social Advantage with Mixed Entangled States”, Aritra Das and Pratyusha Chowdhury, *Journal of Quantum Information Science*, **10**, 11—22, DOI: [10.4236/jqis.2020.102002](#) (2020). Also in *Proceedings of XXX IUPAP Conference on Computational Physics* (2018).
2. “Transition to Turbulence in Driven Active Matter”, Aritra Das, Jayanta K. Bhattacharjee and Ted R. Kirkpatrick, *Physical Review E*, **101(2)**, 23103—23115, DOI: [10.1103/PhysRevE.101.023103](#) (2020).
3. “Hopf Bifurcation Analysis and Existence of Heteroclinic Orbit and Homoclinic Orbit in an Extended Lorenz System”, Aritra Das, Soumya Das and Pritha Das, *Differential Equations and Dynamical Systems*, DOI: [10.1007/s12591-020-00556-2](#) (2020).
4. “Order and Chaos around Resonant Motion in Librating Spring–mass–spherical pendulum”, Anurag, Aritra Das and Sagar Chakraborty, *Nonlinear Dynamics*, **104**, 3407—3424, DOI: [10.1007/s11071-021-06455-7](#) (2021).

Accepted for Publication:

1. “Blind Quantum Factorization of 21”, Barry C. Sanders and Aritra Das. Outcome of [research internship at IQST Calgary](#), accepted to *Physical Review A*.

RELEVANT COURSEWORK

Physics (Theory) Classical Mechanics I & II, Nonlinear Dynamics & Chaos, Statistical Mechanics, Optics, Classical Electrodynamics, Quantum Physics, Quantum Mechanics I, Special Relativity, Thermal Physics, Mathematical Methods I, Computational Physics, Evolutionary Game Dynamics.

Physics (Lab) Optics, Modern Physics, Experimental Physics.

Mathematics Logic, Calculus, Complex Analysis, Partial Differential Equations, Linear Algebra, Abstract Algebra, Topics in Topology.

Computer Science Fundamentals of Computing, Data Structures & Algorithms, Quantum Computing.

Engineering Engineering Graphics, Introduction to Electronics, Manufacturing Processes I & II, Fluid Mechanics.

ACADEMIC AND EXTRA CURRICULAR ACHIEVEMENTS

2019	Shortlisted for Chinese Government Scholarship 2019-2020 for undergraduate programs
2019	Recipient of Shastri Research Student Fellowship (SRSF) 2018-19 , awarded by Shastri Indo-Canadian Institute, Govt. of India for an 11-week internship on “Secure Quantum Computing on the Cloud” under supervisor Prof. Barry Sanders, Director, Institute for Quantum Science and Technology, University of Calgary
2019	Stood first in band and pair-on-stage competition in Galaxy 2019 (annual inter-hall cultural championship at IITK)
2018	Youngest candidate selected for an oral talk at the Conference on Computational Physics, UC Davis
2017	Keyboardist in college band which competed in Mantra (Indian rock band competition) at Mood Indigo (biggest cultural fest in Asia, hosted by IIT Bombay) and stood fourth
2016	Recipient of INSPIRE award, Department of Science & Technology, Government of India, based on JEE Advanced rank
2016	West Bengal Joint Entrance Examination rank 92 (> 0.15 million candidates)
2016	Joint Entrance Examination Mains rank 2376 (> 1.2 million candidates)
2016	Joint Entrance Examination Advanced rank 2354 (> 0.14 million candidates)
2016	Award for Excellence in Science and Math at 12th grade
2014	Award for Excellence in Social Science, Science and Math at 10th grade
2013 & 2012	Certificate of Excellence in IAIS Assessments, McMillan Education, UNSW Global
2012	Certificate of Excellence, Lycee Francis de Pondichery, LLG Paris exam
2011	Senior Diploma in keyboards, Sri Aurobindo Institute of Culture

TECHNICAL STRENGTHS

Languages	Java, C, Python, Javascript, HTML, CSS
Scientific Software	MATLAB, Mathematica, Qiskit, \LaTeX , Git
Other Software & Tools	Autocad, Inventor, Photoshop, Illustrator, Logic Pro
Operating Systems	Windows, Macintosh, Linux

POSITIONS OF RESPONSIBILITY

Music Club, MnC Council, Students’ Gymkhana, IITK *July 2018 - March 2019*
Coordinator *Certificate*

- Managed a club of ≈ 40 musicians along with two other coordinators.
- Conducted annual and biannual flagship events where we performed original compositions and covers of songs from genres like blues, progressive rock, jazz, funk and Indian.
- Composed, recorded and performed original music at college fests and music competitions.

Counselling Service, IITK *July 2017 - March 2018*
Academic Mentor, Physics, UG Wing *Certificate*

- Helped freshmen with electrodynamics (PHY103) through one-on-one doubt-clearing sessions.
- Taught freshmen at hall-level and institute-level doubt-clearing sessions.
- Personally guided academically weak freshmen through all their courses.

HOBBIES AND PASSIONS

- Music Composing and playing jazz fusion; I have studied western piano formally for 10 years and self-learnt the guitar and bass. I also learned some Indian classical vocals and Rabindra Sangeet early on. [SoundCloud profile](#)
- Photography Natural landscape photography and digital photo editing
- Travelling Experiencing the culture and gastronomy of people worldwide (USA, Canada, England, France, Italy, Turkey, Egypt, Middle East, Asia, China, Thailand etc.)

(As of July 14, 2022)