

Curriculum Vitae

Praveen Jayakumar

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Last updated: December 2025

RESEARCH FOCUS Developing novel methods for solving chemistry problems on a quantum computer. Under supervision of Prof. Artur F. Izmaylov¹

PUBLICATIONS **P. Jayakumar**, T. Zeng, A. F. Izmaylov, "On the Feasibility of Exact Unitary Transformations for Many-body Hamiltonians." arXiv:2510.10957, October 2025 (updated December 2025).

S. Patel, **P. Jayakumar**, R. Huang, T. Zeng, A. F. Izmaylov, "Quantum Seniority-based Subspace Expansion: Linear Combinations of Short-Circuit Unitary Transformations for Efficient Quantum Measurements." arXiv:2509.01061, September 2025 (updated December 2025).

S. Patel, **P. Jayakumar**, T. C. Yen, A. F. Izmaylov, "Quantum Measurement for Quantum Chemistry on a Quantum Computer." Chem. Rev. 2025, 125, 16, 7490–7524, July 2025.

P. Jayakumar, P. J. Nadkarni, and S. S. Garani, "Efficient recursive encoders for quantum Reed-Muller codes towards Fault tolerance." arXiv:2405.14549, May 2024.

P. J. Nadkarni, **P. Jayakumar**, A. Behera, and S. S. Garani, "Entanglement-assisted Quantum Reed-Muller Tensor Product Codes." Quantum 8:1329, May 2024.

CONFERENCES Poster titled "*On the Feasibility of Exact Unitary Transformations for Many-body Hamiltonians*." presented at the Applied Quantum Computing Symposium 2025, University of Sherbrooke. Nov, 2025

Talk titled "*Conditions for Efficient Unitary Transformation of Many-Body Hamiltonians*" presented at the Symposium of Chemical Physics, University of Waterloo. Nov, 2025

Poster titled "*Reductions in Heisenberg transformed Hamiltonians for Distributed Quantum Chemistry*." presented at the Annual General Meeting of the Quantum Software Consortium. July, 2025

Talk titled "*Error mitigation via measurement groups: Making quantum computers to do chemistry*" presented at the Symposium of Chemical Physics, University of Waterloo. Nov, 2023

TEACHING Teaching assistant, CHM21B (Chemical Structure and Spectroscopy) Winter, 2025

¹Department of Physical and Environmental Sciences, University of Toronto Scarborough. artur.izmaylov@utoronto.ca

WORK EXPERIENCE	Teaching assistant and lab demonstrator, PHYA11	Winter 2024, Fall 2025
	Marker, CHM1478HS (Quantum Mechanics for Physical Chemists)	Winter 2024, Fall 2025
	Teaching assistant and lab demonstrator, PHYA10H	Fall 2023, 2024
	Lab demonstrator, CHM135H	Fall, 2022
	TA, Digital signal processing (NPTEL)	2020, 2021
	Xanadu summer resident Error correction researcher - GKP code and decoder design.	Summer, 2024
PREVIOUS RESEARCH PROJECTS	Fermionic reflection ansatz for efficient VQE methods Under the guidance of Prof. Artur F. Izmaylov Explored optimization techniques for mean field rotated reflection unitaries for efficient VQE ansatz in the fermionic space, motivated by previous works on coupled clusters in qubit spaces and their iterative analogues.	2021 July- 2022 May
	Quantum communication and error correction Under the guidance of Dr Shayan Srinivasa Garani ² – Studied entanglement properties of quantum RM codes and it's usecases on quantum networks and entanglement distribution/purification. Developed efficient near optimal encoders. – Designed entanglement assisted codes, quantum tensor product codes from RM codes and their entanglement assisted versions that show positive catalytic rates. Presented, ITA 2023	2019 May- 2021 July
	iGEM 2019, Hardware team Design the hardware components of the project Synshine, IISc Bangalore.	2018 December - 2019 November
	Ion trapping for Ca ions Under the guidance of (late) Prof. Vasant Natarajan ³ worked on constructing a linear Paul trap to trap singly ionized Calcium ions for executing Quantum Computation.	2018 May- 2018 July
WRITING WORKSHOPS & TALKS GIVEN	Science writing Intern at Office of Communication, Indian Institute of Science Developing Effective Methodologies to Teach Quantum Information Science to Early-Stage Learners (As a part of IEEE Quantum Week 2021) Introduction to quantum computing (As a part of Quantum Communications Workshop 2021, IEEE-IISc) Introduction to quantum computing algorithms (As a part of IEEE-IISc student seminar series)	2022 March- 2022 July 2021 Oct 2021 Sept 2021 July
ACADEMIC WORKSHOPS	IBM GSS 2021, IBM GSS 2020, STAQ summer school (by Duke university) Radio Astronomy Workshop At the International Center for Theoretical Studies (ICTS) Cryptography	2020, 2021 2018 2012

²Department of Electronic Systems Engineering, IISc. shayangs@iisc.ac.in

³Department of Physics, Indian Institute of Science

3 week summer course conducted by Duke University, where I was introduced to Cryptography.

EDUCATION

University of Toronto

Doctoral student, under supervision of Prof. Artur Izmaylov
Department of Chemistry

2022 Fall-

Research focus: Quantum computing algorithms for Quantum Chemistry
Current grade: A

Indian Institute of Science (IISc), Bengaluru, India

5-Year Bachelor of Science + Masters of Science with a major in **Physics**
CGPA - **8.9 / 10.0** (Distinction)
GRE (General): **326**/340 ToEFL: **103**/120

2017 - 2021

AMM Matriculation

PUC I and II (equivalent to grades 11 and 12),
Department of Government Examinations, TAMIL NADU.
Class 12 : 96 %

2017

AMM Matriculation

Grades 1 - 10, Department of Government Examinations, TAMIL NADU.
Class 10 : 97.2 %

2015

RELEVANT COURSES

Graduate level

COMPLETED

Quantum computing, Quantum Mechanics for Quantum Chemists, Quantum information Theory, Quantum Optics, Linear Algebra and Optimization, Statistical Mechanics, Advanced Math methods, Information theory, Quantum mechanics, Advanced cryptography (Pseudo-randomness, randomness extractors and expanders), Quantum measurements, Theoretical foundations of Cryptography

TECHNICAL SKILLS

Programming languages

Python, L^AT_EX, C, C++, Octave, MATLAB, R
Quantum computing packages: Qiskit, Cirq, Tequila, Pennylane

FELLOWSHIPS AND AWARDS

Kishore Vaigyanik Protsahan Yojana [**KVPY-SA**]

2017 Aug-

All India Rank : 94

2022 July

Includes stipend and contingency

Student of the year

2017

AMM School, Chennai, India

Qualified for Indian National Olympiad for Infomatics (INOI), Indian National Mathematics Olympiad (INMO)

2016

EXTRA-CURRICULAR

Member and executive member at The University of Toronto Toastmasters club
(Region 6, district 60, Division A, Area 11)

2023 May -
2025 Feb

Contributor and curator at https://fullstackquantumcomputation.tech/	2020 August -
Executive member of IEEE IISc Communication Society student chapter	2021 April -
Quarks 2019 IISc UG's Annual magazine, design coordinator and part of editorial team.	2022 April 2019 June - 2020 March
Notebook drive, IISc Teach basic English, computer skills and science to underprivileged children	2018 Aug - 2020 Jan
Pravega - Coordinator - Corporate relations Managing corporate communications and sponsorship for Pravega 2019, IISc's Annual Science, technical and cultural fest. www.pravega.org	2018 Jan - 2019 Jan
Undergraduate engineering club, IISc - Coordinator Conduct and arrange sessions on interesting topics	2018 June - 2019 June
Student Council (School) - Head Led the school Student council, previously was assistant student body leader	2016 July - 2017 April