

Curriculum Vitae

Praveen Jayakumar

PhD candidate, University of Toronto
praveen.jayakumar@mail.utoronto.ca
praveen91299@gmail.com
github.com/Praveen91299
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

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

WORK EXPERIENCE

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

Science writing Intern at Office of Communication, Indian Institute of Science	2022 March- 2022 July
--	--------------------------

WORKSHOPS & TALKS GIVEN

Developing Effective Methodologies to Teach Quantum Information Science to Early-Stage Learners (As a part of IEEE Quantum Week 2021)	2021 Oct
Introduction to quantum computing (As a part of Quantum Communications Workshop 2021, IEEE-IISc)	2021 Sept
Introduction to quantum computing algorithms (As a part of IEEE-IISc student seminar series)	2021 July

ACADEMIC WORKSHOPS

IBM GSS 2021, IBM GSS 2020, STAQ summer school (by Duke university)	2020, 2021 2018
Radio Astronomy Workshop At the International Center for Theoretical Studies (ICTS)	
Cryptography	2012

²Department of Electronic Systems Engineering, IISc. shayang@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 Research focus: Quantum computing algorithms for Quantum Chemistry Current grade: A 2022 Fall-
	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	<i>Programming languages</i> Python, L ^A T _E X, C, C++, Octave, MATLAB, R Quantum computing packages: Qiskit, Cirq, Tequila, PennyLane
FELLOWSHIPS AND AWARDS	Kishore Vaigyanik Protsahan Yojana [KVPY-SA] <i>All India Rank : 94</i> Includes stipend and contingency 2017 Aug-2022 July
	Student of the year AMM School, Chennai, India 2017
	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	2022 April
IISc UG's Annual magazine, design coordinator and part of editorial team.	2019 June -
	2020 March
Notebook drive, IISc	2018 Aug -
Teach basic English, computer skills and science to underprivileged children	2020 Jan
Pravega - Coordinator - Corporate relations	2018 Jan -
Managing corporate communications and sponsorship for Pravega 2019, IISc's Annual Science, technical and cultural fest. www.pravega.org	2019 Jan
Undergraduate engineering club, IISc - Coordinator	2018 June -
Conduct and arrange sessions on interesting topics	2019 June
Student Council (School) - Head	2016 July -
Led the school Student council, previously was assistant student body leader	2017 April