Carlos Eduardo Tavares

Curriculum Vitae

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Summary

Researcher in quantum computation with extensive experience in software development and engineering. Interested in computational models and the physics that enables them, particularly quantum, as well as the science of programming and algorithms of all kinds.

Education

May 2022 **Doctor of philosophy (Ph.D.)**, *University of Minho, Aveiro e Porto (MAP-i)*, Braga, Portugal.
MAP-i is a joint doctoral programme in computer science offered by the portuguese universities of Minho, Aveiro and Porto .

Thesis: "Foundations for Quantum Algorithms and Complexity" (Area: Quantum computing).
Approved by unanimity, Very Good.

Sep 2015 **Ph.D. Course**, *University of Minho, Aveiro e Porto (MAP-i)*, Porto, Portugal.
Completed the curricular part of the MAP-i on a part-time basis, including several courses on machine learning, cryptography and quantum computing.

Jul 2008 **MSc, Informatics Engineering**, *Faculty of Engineering of University of Porto*, Porto, Portugal, *16 out of 20.*
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Thesis: "Context Awareness in a Personal Health Assistant" (Area: IOT for health)

Oct 2007 ***Licenciatura* in Informatics Engineering (pre-Bologna)**, *Faculty of Engineering of University of Porto*, Porto, Portugal, *16 out of 20.*.

Positions

Sep 2022 - **Invited auxiliary professor**, *University of Minho*, Guimarães, Portugal.
Lecturer in programming, algorithms and computational systems courses.

Jan 2023 - August 2024 **Research Fellow**, *International Iberian Nanotechnology Laboratory (INL)*, Braga, Portugal.
Postdoctoral Researcher in the quantum and linear-optical computation group (QLOC group).

Apr 2014 - Nov 2022 **Doctoral Researcher**, *High-Assurance Software Laboratory (HASLAB)*, Braga, Portugal.
Researcher focused on the application of logical and formal methods in quantum computation and quantum technologies.

Feb 2017 - 2018 **Invited assistant professor**, *University of Minho*, Braga, Portugal.
Lecturer of the quantum computation course of the physics engineering degree.

Oct 2011- Jan 2015 **Software Engineer**, *MOG Technologies*, Maia, Portugal.
Development and engineering of several software products targeted to the professional video market.

Feb 2007 - Sep 2011 **R&D Engineer**, *INESC Porto*, Porto, Portugal.
Research and Development Engineer in several national and international research projects in Ambient Assisted Living (IOT for heatlh) and Power Systems.

Research projects

Jan 2023 - Sep 2024 **Project Phoqusing - Photonic Quantum Sampling Machine (INL)**.
[Role: Post-doc Researcher] Project funded by the European Union's HORIZON 2020 Research and Innovation Programme. The project focuses on studying quantum computational models using linear optical devices, e..g. boson sampling, utilizing Europe's largest linear interferometers as the experimental setting. I contributed with several works concerning the certification of the quantum advantage in these devices and new computational applications, which resulted in software and publications.

Abr 2015 - Sep 2015 **Project QAIS - Quantitative anaysis of Systems (HASLAB)**.
[Role: Doctoral Researcher] Project funded by the Foundation for Science and Technology (FCT) (PTDC/EIA-CCO/122240/2010), focused on the foundations of quantitative systems. I contributed by preparing a technical report on quantum algorithms and computational techniques.

Abr 2009 - Oct 2010 **Project Reserve (INESC Porto)**.
[Role: Junior Researcher] This project was funded by two industrial partners in the energy sector: Rede Eléctrica Nacional and Red Eléctrica de España. The project aimed to develop a tool for performing Monte Carlo simulations of the power network to obtain realistic estimates of the network's reliability indexes. My contribution involved developing a graphical interface to facilitate user interaction with the tool, which resulted in software delivered to the end client.

Jun 2009 - Oct 2011 **Project eCAALYX (INESC Porto)**.
[Role: Junior Researcher] This project was the continuation of the CAALYX project and my contribution was essentially the same that of such project.

Fev 2007 - Mar 2009 **Project CAALYX - Complete Ambient Assisted Living Experiment (INESC Porto)**.
[Role: Junior Researcher] The project aimed to develop assistive technology for health monitoring and providing assistance to elderly people living in remote environments, using health sensors, mobile phones and smart tv boxes. My main contribution involved developing one of the project's main components, the mobile system, which resulted in software (mobile application) and publications. The project received the highest possible classification from the funding entity, which was the European Union.

Honors and awards

2017 **Individual Foundation for Science and Technology (FCT) grant**.
Individual research grant (reference SFRH/BD/116367/2016) awarded by the Foundation for Science and Technology under the national computer science Ph.D. grants call (I ranked 8^{th} out of 45 applicants). This individual research project concerned the development of logical formalisms to deal with quantum programs, specializing in those regarding common quantum algorithms, and resulted in several publications.

2015 **Individual INESC TEC grant**.
Research grant funded by INESC TEC through its nationally awarded funds (reference INESC TEC-EEA/50014).

2015 **Invidual FCT grant**.
Research grant funded under the FCT project 'QAIS - Quantitative Analysis of Systems' (reference PTDC/EIA-CCO/122240/2010).

2009 **"Fora de Série" prize of INESC Porto.**.
IINESC Porto prize awarded to the most distinguished employee of the month. Nominated by the communication department based on recommendations from various group leaders. I was selected following the successful conclusion of the CAALYX project.

2007 **Individual INESC Porto grant**.
Several research grants funded under CAALYX and eCAALYX EU research projects.

Software packages

2024- **Quindcert (under construction)**.
A Python toolbox designed to assist in the certification of quantum optical devices, focusing on photonic indistinguishability, as well as unitary and Gram matrix reconstructions.

Publications

Conference papers

2009 P. Van de Ven, A. Bourke, C. Tavares, R. Feld, J. Nelson, A. Rocha, and G.O. Laighin, Integration of a Suite of Sensors in a Wireless Health Sensor Platform, *Sensors*, 2009 IEEE, pp. 1678–1683, Oct. 2009.

2012 Alan K. Bourke, Sandra Prescher, Friedrich Koehler, Victor Cionca, Carlos Tavares, Sergi Gomis, Virginia Garcia, and John Nelson, Embedded Fall and Activity Monitoring for a Wearable Ambient Assisted Living Solution for Older Adults, *Engineering in Medicine and Biology Society (EMBC)*, 2012 Annual International Conference of the IEEE, pp. 248–251, 2012.

2019 Carlos Tavares, A Dynamic Logic for QASM Programs, *International Workshop on Dynamic Logic*, pp. 209–217, Springer, 2019.

2022 José D. Guimarães and Carlos Tavares, Towards a Layered Architecture for Error Mitigation in Quantum Computation, *2022 IEEE International Conference on Quantum Software (QSW)*, pp. 41–51, 2022.

Journal Papers

2011 M.N.K. Boulos, S. Wheeler, C. Tavares, and R. Jones, How Smartphones are Changing the Face of Mobile and Participatory Healthcare: An Overview, with Example from eCAALYX, *Biomed Eng Online*, vol. 10, 2011. - **[Q2]; $>$ 1000 citations**

2020 José Diogo Guimarães, Carlos Tavares, Luís Soares Barbosa, and Mikhail I. Vasilevskiy, Simulation of Nonradiative Energy Transfer in Photosynthetic Systems Using a Quantum Computer, *Complexity*, 2020. - **[Q1]**

2021 Carlos Tavares, Sofia Oliveira, Vitor Fernandes, Andrei Postnikov, and Mikhail I. Vasilevskiy, Quantum Simulation of the Ground-State Stark Effect in Small Molecules: A Case Study Using IBM Q,*Soft Computing*, vol. 25, no. 9, pp. 6807–6830, 2021. - **[Q2]**

Pre-prints

2024 Giovanni Rodari, Leonardo Novo, Riccardo Albiero, Alessia Suprano, Carlos T. Tavares, Eugenio Caruccio, Francesco Hoch, Taira Giordani, Gonzalo Carvacho, Marco Gardina, et al., Semi-Device Independent Characterization of Multiphoton Indistinguishability, *arXiv preprint arXiv:2404.18636*, 2024. - to appear in PRX Quantum (Q1) in early 2025.

(For a detailed analysis of paper citations please see the document attached in the end of this cv)

Refereeing

Journal Refereeing

2022 **Journal of Logical and Algebraic Methods in Programming (JLAMP)**, *Elsevier*.

2022 **Scientific Reports**, *Nature Publishing Group*.

2017 **JMIR mHealth and uHealth**, *JMIR Publications*.

2017 **Research and Practice in Anesthesiology**, *Hindawi Journals*.

Conference refereeing

2016 **Simpósio Brasileiro de Métodos Formais (SBMF)**, *Natal, Rio Grande do Norte, Brazil*.

2018 **14th International Symposium on Algorithms and Experiments for Wireless Networks (ALGOSensors)**, *Helsinki, Finland*.

Invited talks and small courses

Sep, 2016 **Workshop on "Quantum materials and Quantum technologies"**, *"From Feynman to Stochastic optimization: a brief survey"*.
Iberian International Nanotechnology Laboratory, Braga, Portugal

Oct, 2016 **InfoBlender Seminar**, *"Beyond Breaking RSA - Algorithms and applications of quantum computation"*.
Department of Informatics, University of Minho, Braga, Portugal

Sep, 2017 **1st DaLí workshop: Dynamic Logic: new trends and applications**, *"Towards a quantum-probabilistic dynamic logic"*.
University of Brasília, Brasília, Brasil

Nov, 2017 **Workshop "Quantum techniques in Machine Learning"**, *"Quantum Machine group learning"*.
University of Verona,Verona, Italy

Apr, 2019 **Q-Days 2019 (Workshop on quantum information and computation)**, *"Quantum simulation"*.
University of Minho,Braga, Portugal

Jul, 2019 **Workshop "Process Modeling and Self-Organization: Methods and Applications."**, *"Quantum simulation of biological systems"*.
Artificial Life 2019, Newcastle University, United Kingdom

Oct, 2019 **2nd Dalí workshop: Dynamic Logic: New Trends and Applications** , *"A dynamic logic for QASM programs"*.
3rd World Congress on Formal methods 2019, Porto, Portugal

Sep, 2022 **An introductory course on quantum computing organized by University of Aveiro**, *"A brief journey on quantum computation"*.
Departamento de Matemática, Universidade de Aveiro, Aveiro, Portugal

Dec, 2023 **QLOC group seminars**, *"Indistinguishability witnesses: a case for expected variance"*.
International Iberian Nanothechnology Laboratory, Braga, Portugal

Teaching Duties

2016-2017, 2017-2018 **Department of Informatics, University of Minho, Braga, Portugal**, *Quantum computing*.
Lecturer in the quantum computing course to the 4^{th} year of the Physics engineering degree (first two editions)

2022-2023, 2023-2024, 2024-2025 **Department of Informatics, University of Minho, Braga, Portugal**, *Programming and Algorithms*.
Course Responsible of the programming and algorithms course of the 1^{st} year of the Aerospace Engineering degree.

2022-2023 **Department of Informatics, University of Minho, Braga, Portugal**, *Computational Systems*.
Teaching Assistant in the computational systems course of the 1^{st} year of the Data science degree.

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For more details about my teaching duties, including pedagogic materials, please consult my website: https://cttavares.github.io/www/

Student supervision

2019-2020 **Student supervision**, *Department of Informatics*, University of Minho, Portugal.
Co-supervision, with Luís Soares Barbosa, of the MSc student José Diogo Guimarães. with thesis entitled: "Simulation of quantum effects in biology". Finished in July, 2020.

2017-2018 **Student supervision**, *Department of Informatics*, University of Minho, Portugal.
Co-supervision, with Luís Soares Barbosa, of the MSc student Afonso Rodrigues. Thesis: "Validation of Quantum Simulations". Finished in October, 2018.

2010-2011 **Student supervision**, *Department of Informatics*, INESC Porto, Portugal.
Co-supervision, with André Sousa, of the BSc student André Sousa. Thesis: "Reengineering of an Observation pattern engine". Finished in July, 2011.

Juries

2020 **Simulation of quantum effects in biology**, *University of Minho*, Braga, Portugal.
Participated in the evaluation jury for the Master degree of the student José Diogo Guimarães

Outreach Events

May 18, 2024 **Open day INL 2024**, *International Iberian Nanotechnology Laboratory*, Braga, Portugal.
Dissemination of scientific knowledge for the general public of all ages.

Nov 2018 **Web Summit**, *Portugal*.
Liaison with industrial partners interested in exploring quantum computing applications in Portugal through a partnership with IBM.

Oct 25, 2016 **Workshop on Quantum technologies in Portugal**, *Academia das Ciências de Lisboa*, Portugal.
A national gathering of laboratories and groups developing quantum technologies in Portugal, aimed at identifying common interests and establishing cooperation networks.

Sep 8, 2016 **Open day HASLAB 2016**, *University of Minho, Laboratório de Software Confiável*, Portugal.
Dissemination of research conducted at the High-Assurance Software Laboratory to potential national industry partners.

Dec 2008 **e-Inclusion Ministerial Conference and Expo**, Vienna, Austria.
Presentation of the CAALYX project at the Ambient Assisted Living specialty exhibition, featuring participation from all EU-funded research projects at the time.

Societies and assotiations membership

2016-2018 **Quantalab**, Portugal.
Association with researchers from several universities and research laboratories in Northern Portugal, aimed at establishing a laboratory for advancing research in quantum technologies following the creation of the Quantum Flagship by the European Union. I participated in several meetings and project proposals in the field of quantum computing, particularly for FCT and European (QuantEra) calls.

2012-2015 **Society of Motion Picture and Television Engineers**, United States of America.
Member of the Society of Motion Picture and Television engineers responsible to manage the standards of information representation and exchange for the professional video market worldwide. Participated, as a voting member, in the definition of several standards.

Courses and professional valorization events

Jan 2018 **Days in Logic 2018**, *University of Aveiro*, Portugal (conference).

Sep 2017 **From proof systems to complexity bounds**, *University of Brasília* , Brasília, Brasil (small course).

May 29 – Jun 4, 2017 **1st School on Foundations of Programming and Software systems. Probabilistic programming**, *University of Minho*, Aveiro, Portugal (school with several courses).

Feb 2017 **Quantum information**, *University of Minho*, Braga, Portugal (course).

Jul 2015 **Quantum Physics and Logic 2015**, *University of Oxford Mathematical Institute*, United Kingdom (conference).

Jul 2015 **Entrepreneurship**, *University of Porto*, Porto, Portugal (course).

Mar 2015 **Adaptive Business Intelligence**, *Porto*, Portugal (course).

Oct 2014 **ICEGOV'14**, *University of Minho - Campus de Azurém*, Portugal (conference).

Jun 2014 **Summer School on Exploiting Multicore and Accelerator Systems: Programming and Applications**, *University of Minho*, Portugal (school with several courses).

Jul 2014 **Quantum mechanics**, *University of Minho*, Braga, Portugal (course).

May 2014 **Spring School on Quantum Structures**, *University of Oxford Mathematical Institute*, United Kingdom (school with several courses).

Mar 2014 **Cryptography and Information Security**, *University of Minho*, Braga, Portugal (course).

Mar 2014 **Knowledged discovery from databases**, *University of Minho*, Braga, Portugal (course).

Mar 2013 **Cryptography I**, *University of Stanford*, Stanford, USA (course).

Other relevant professional achievements

Feb 2007 - Sep 2011 **While being a R&D Engineer at**, *INESC Porto*, Porto, Portugal.

- In addition to official outreach events, I organized numerous internal and external demonstrations for the CAALYX and eCAALYX projects;
- Assisted in organizing field trials with elderly users in Ancona, Italy, which lasted several weeks. This included providing extensive on-site technical support to all project partners;
- The successful conclusion of the CAALYX project generated an income of around €200K for the group and indirectly led to the acceptance of two subsequent projects—eCAALYX and CAALYX-MV—building on CAALYX's technological advancements;
- Contributed to the specification of the information system supporting Greece's transition from fixed energy vendors to a free energy market, leveraging my expertise in UML modeling.

Oct 2011- Jan 2015 **While being a Software Engineer at**, *MOG Technologies*, Maia, Portugal.

- Led the development and managed three of the company's core products: MXF::SDK, MXF::SDK::MODULES, and MOG::Components. Responsibilities included advanced client support, budgeting, implementing new features, and release planning;
- Served as the deputy team leader, stepping into the team leader role during their absence;
- Oversaw standardization activities within the Society for Motion Picture and Television Engineers (SMPTE) and AMWA;
- Contributed to multiple innovations in the company's products, including developing the first prototype for metadata extraction based on speech recognition software.

Technical/Scientific skills

Scientific skills:.

- **Physics:** Strong background on **quantum computing** and on several related areas, such as quantum foundations, quantum mechanics, quantum logic and quantum optics;
- **Computer science:** Background in many fields of computer science:
  - **(Strong)** Quantum algorithms;
  - **(Strong)** Foundations of programming and computation particularly on the semantics of programming languages and logic (dynamic logic);
  - **(Good)** Classical algorithms and machine learning (beginner in deep learning and Large Language Models);
  - **(Good)** Computational models including deterministic, concurrent, distributed, probabilistic and quantum;
  - **(Beginner)** Cryptography;
- **Research, technical and scientific writing.**

Programming/Software development skills:.

- Professional Experience with C++ (**3 years**), Java (**4 years**), C# (**1 year**), python (**2 years**);
- Academic experience with C, haskell, Rust, Prolog, Javascript, SQL;
- Strong background on software engineering;
- Knowledge of formal methods and excellent understanding of the UML modeling language;
- Software and frameworks:
  - **Quantum:** Qiskit, Perceval;
  - **Mobile:** Android;
  - **Digital Video**: Material Exchange Format standards;

Management/Business skills.

- Technical product management;
- Knowledge of software-related and innovation management tasks.

Title	Publication	Year	Publication Info (Core or Quarter)	Google Scholar		Scopus		Web of Science		DBLP	CrossRef	
				Indexed	Citations	Indexed	Citations	Indexed	Citations	Indexed	Indexed	Citations
How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX	Biomedical engineering online **(journal)**	2011	**Q2** (Web of Science and Scopus)	yes	1551	yes	811	yes	647	no	yes	698
Integration of a suite of sensors in a wireless health sensor platform	SENSORS, 2009 IEEE **(conference)**	2009	**Unranked on Core**	yes	19	yes	12	yes	4	no	yes	4
Embedded fall and activity monitoring for a wearable ambient assisted living solution for older adults	2012 Annual International Conference of the IEEE Engineering in Medicine and Biology Society **(conference)**	2012	**A** (Era2010 ranking) **C** (Core2018)	yes	28	yes	0	yes	11	yes	yes	10
A dynamic logic for QASM programs	International Workshop on Dynamic Logic **(conference)**	2019	**Unranked on Core**	yes	2	yes	0	yes	0	yes	yes	0
Simulation of nonradiative energy transfer in photosynthetic systems using a quantum computer	Complexity **(journal)**	2020	**Q1** (Scopus) **Q2** (Web of Science)	yes	9	yes	4	yes	4	yes	yes	5
Quantum simulation of the ground-state Stark effect in small molecules: a case study using IBM Q	Soft Computing **(journal)**	2021	**Q2** (Web of Science and Scopus)	yes	13	yes	8	yes	8	yes	yes	9
Towards a layered architecture for error mitigation in quantum computation	Quantum Software 2022, IEEE **(conference)**	2022	**Unranked on Core**	yes	4	yes	4	yes	5	no	yes	3
Semi-device independent characterization of multiphoton indistinguishability	PRX Quantum (to appear, only available on ArXiv)	2025 (expected)	-	yes	1	no	0	no	0	no	no	0
			Total citations:		**1627**		**839**		**679**			**729**
			h-index		**5**		**4**		**4**			**4**
			h10-index		**3**		**2**		**2**			**2**