

Mina Doosti

Curriculum Vitae

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Overview

I am a Chancellor's Fellow (UK equivalent of tenure-track assistant professor) at the University of Edinburgh. As a researcher in quantum information sciences and cryptography, my focus is on the intersection of quantum computing with cryptography and learning theory. I aim to bridge different disciplines in computer science, physics, and mathematics to tackle theoretical problems, identify bottlenecks in current quantum architectures, and develop novel applications for quantum technologies.

Education

- 2018–2022 **PhD**, Doctor of Philosophy from *The Laboratory for Foundations of Computer Science (LFCS), School of Informatics, University of Edinburgh*
Thesis title: Unclonability and Quantum Cryptanalysis: From Foundations to Applications.
Supervisor: Prof. Elham Kashefi, Second Supervisor: Dr. Myrto Arapinis
Examiners: Anne Broadbent and Petros Wallden
- 2015–2017 **M.Sc. in Physics**, *Physics Department, Sharif University of Technology*
Thesis title: Superposition of orthogonal states and no-go theorems in Quantum Mechanics.
Supervisor: Prof. Vahid Karimipour
- 2010–2014 **B.Sc. in Physics**, *Physics Department, Sharif University of Technology*.

Research Experience

- 2023–now **Chancellor's Fellow** at *Quantum Software Lab (QSL), School of Informatics, University of Edinburgh*.
- 2022–2023 **Senior Researcher** at *The Laboratory for Foundations of Computer Science (LFCS), University of Edinburgh*.
I lead research on quantum hardware security, quantum pseudorandomness, quantum machine learning and distributed quantum computing.
- 2021–2022 **Research Associate** at *The Laboratory for Foundations of Computer Science (LFCS), University of Edinburgh*.
working on unclonability, cryptanalysis and quantum cryptography, quantum machine learning and quantum differential privacy.
- 2020–2021 **Research Intern** at *VeriQloud*, Mentor: Marc Kaplan
I worked as a research intern at VeriQloud, a quantum startup based in France, to conduct a feasibility study regarding the applications of quantum protocols and the quantum communication infrastructure in Europe.
- 2018–2020 **Quantum Protocol Zoo Contributor and Research Collaborator** *Quantum protocol zoo, is an open repository of protocols for quantum networks (<https://wiki.veriqloud.fr>)*.
Within this project, I worked on the study, modularization and standardization of quantum protocols as part of the European Quantum Internet Alliance (QIA) project.
- 2014–2017 **Research Assistant**, Quantum Information and Computation Group, *Sharif University of Technology*,
I worked on various topics including quantum foundations, and no-go theorems and quantum resource theory.

Selected Awards and Honors

- Jan 2022 **Hartree Fellowship**, Awarded a highly competitive independent research fellowship at QUICS, Joint Center for Quantum Information and Computer Science, Maryland.
- Jan 2022 **Perimeter Institute Postdoctoral Fellowship**, Awarded a highly competitive 3-year research fellowship at Perimeter Institute. (declined the offer)
- May 2020 **School winner of Three Minute Thesis**, School of Informatics, University of Edinburgh.
- July 2019 **2nd place award in QuHackEd: The first Quantum Hackathon in Scotland**, University of Edinburgh.
- Sep 2018 **Fully Funded PhD Scholarship**, School of Informatics, University of Edinburgh.

Selected Research Grant Contributions

Practical Quantum Cryptography from Hardware Assumptions - Cisco, Col, Grant Amount: 100K USD.

AirQKD, Contributor, project: "PUF-enhanced QKD authentication", Total Grant Amount: 7.5M GBP, UoE budget: 261K GBP.

Quantum Computing Platform For NISQ Era Commercial Applications, Contributor and sub-project leader, Grant Amount (UoE budget): 103K GBP.

Quantum Internet Alliance, Quantum protocol design work package contributor, student and intern supervisor, Total Grant Amount: 24M Euros.

Selected Management and Leadership Experience

- Research Leadership **Co-founder** of a new field of research namely, *quantum hardware security*. Also **founded the research subgroup** of quantum hardware security within the EdiPar quantum lab, leading the research around this topic, opening new research directions such as *quantum identification based on hardware assumptions* and, supervising students and interns.
- Organising committee **Chair and organiser of** *International Workshop on Quantum t-designs and Applications in Quantum Computing*, 23-25 March 2022 - University of Edinburgh (Website link)
- Organising committee **co-organiser of** *Quantum Software Lab Workshop 13-14 December 2022* - University of Edinburgh (Website link)
- Organising committee **Local organiser of** *4th National Conference of Superconductivity - 2014*, Sharif University of Technology

Selected Teaching Experience

- Apr 2022 **Guest lecture** on "Quantum coin-flipping", for the course "Quantum Cyber Security", Lecturer: Petros Wallden, University of Edinburgh.
- 2019-2022 Teaching Assistant, **Quantum Mechanics**, School of Physics and Astronomy, University of Edinburgh.
- 2020-2021 Teaching Assistant, **Introduction to Modern Cryptography**, School of Informatics, University of Edinburgh.
- 2019-2021 Teaching Assistant, **Introduction to Quantum Computation**, School of Informatics, University of Edinburgh.
- 2019-2021 Teaching Assistant, **Dynamics and Vector Calculus**, School of Physics and Astronomy, University of Edinburgh.

2015-2016 Teaching Assistant, **Modern Physics**, *Department of Physics, Sharif University of Technology*.

Publications (Sorted by the most recent)

- [1] Singh, S., Doosti, M., Mathur, N., Delavar, M., Mantri, A., Ollivier, H. and Kashefi, E., 2023. Towards a unified quantum protocol framework: Classification, implementation, and use case. arXiv preprint arXiv:2310.12780
- [2] Wadhwa, C. and Doosti, M. 2023 Learning quantum processes with quantum statistical queries. arXiv preprint arXiv:2310.02075
- [3] Angrisani, A., Doosti, M. and Kashefi, E., 2023. A unifying framework for differentially private quantum algorithms. arXiv preprint arXiv:2307.04733.
- [4] Doosti, M., Hanouz, L., Marin, A., Kashefi, E. and Kaplan, M., 2023. Establishing shared secret keys on quantum line networks: protocol and security. arXiv preprint arXiv:2304.01881.
- [5] Doosti, M., Kumar, N., Kashefi, E., and Chakraborty K., 2022 On the connection between quantum pseudorandomness and quantum hardware assumptions. *Quantum Science and Technology*, 7(3):035004.
- [6] Angrisani, A., Doosti, M., and Kashefi, E., 2022. Differential privacy amplification in quantum and quantum-inspired algorithms. arXiv preprint arXiv:2203.03604, 2022. **Accepted for oral presentation at ICLR 2022**
- [7] Chakraborty, K., Doosti, M., Ma, Y., Wadhwa, C., Arapinis, M., and Kashefi, E., 2021-2. Quantum lock: A provable quantum communication advantage. arXiv preprint arXiv:2110.09469, 2021. **Accepted for publication at Quantum Journal, and for oral presentation at QCrypt 2022**
- [8] Coyle, B., Doosti, M., Kashefi, E. and Kumar, N., 2022. Progress toward practical quantum cryptanalysis by variational quantum cloning. *Phys. Rev. A*, 105:042604, Apr 2022. **Accepted for oral presentation at YQIS 2021**
- [9] Doosti, M., Delavar, M., Kashefi, E., and Arapinis, M., 2021. A Unified Framework For Quantum Unforgeability. arXiv preprint arXiv:2103.13994.
- [10] Doosti, M., Kumar, N., Delavar, M. and Kashefi, E., 2021. Client-server identification protocols with quantum PUF. *ACM Transactions on Quantum Computing*, 2(3), pp.1-40.
- [11] Arapinis, M., Delavar, M., Doosti, M., and Kashefi, E., 2021. Quantum physical unclonable functions: Possibilities and impossibilities. *Quantum*, 5, 475. **Accepted for oral presentation at QCrypt 2019**
- [12] Doosti, M., Kianvash, F., and Karimipour, V. (2017). Universal superposition of orthogonal states. *Physical Review A*, 96(5), 052318.

Selected Oral and Poster Presentations

- November 2023 "The Power of Unknown Unitaries", *Talk at Phoquising workshop, Sorbonne University, LIP6, Paris, France*
- September 2023 "New Resources for Quantum Communication: Exploring Quantum Hardware Security", *Invited talk at International Hub workshop on advances in quantum networking (QNetworks 2023), Glasgow, UK*

- June 2023 "New quantum resources for quantum communication, from quantum hardware security", *Invited talk at Workshop on Entanglement Assisted Communication Networks, Taipei/Taiwan.*
- April 2023 "Quantum cybersecurity and privacy", *Talk at the Quantum Software Lab launch event.*
- March 2023 "New quantum resources from quantum hardware security for the NISQ era", *Invited talk Near-term Quantum Computing Conference 2023, Warsaw, Poland.*
- March 2023 "Unclonability, learnability, and quantum pseudorandomness", *Invited talk at Royal Holloway University of London.*
- Dec 2022 "Quantum Unclonability beyond no-cloning", *Quantum Software Lab workshop, University of Edinburgh.*
- Jul 2022 "Security and Privacy in the quantum era", *Invited talk for Security and Privacy group at the School of Informatics, University of Edinburgh.*
- Nov 2021 "Quantum Physical Unclonable Functions and Their Comprehensive Cryptanalysis", *IQC-QULCS Math-CS Seminar, Joint Center for Quantum Information and Computer Science*
- Oct 2021 "From Quantum Computing to Quantum Mechanics: A journey backwards in time", *Invited public talk for Design Informatics, University of Edinburgh.*
- Mar 2021 "Client-Server Identification Protocols with Quantum PUF", *Invited talk for Qtech QUISCO (Quantum Information Scotland Network) Seminar.*
- Dec 2020 "Quantum Hardware Security, open questions and challenges", *Talk at Quantum Edi-Par workshop 2020 (Joint online workshop between University of Edinburgh quantum group and LIP6, Sorbonne University).*
- Nov 2020 "Quantum Physical Unclonable Functions: Possibilities and Impossibilities", *Invited talk at University of Twente.*
- Nov 2020 "Quantum Physical Unclonable Functions: Possibilities and Impossibilities", *Contributed talk at Quantum Technology International Conference 2020.*
- Nov 2020 "Quantum Protocol Zoo", *Contributed talk at Quantum Technology International Conference 2020.*
- Jun 2020 "Client-Server Identification Protocols with Quantum PUF", *Invited talk at Quantum Internet Alliance (QIA) online consortium.*
- Aug 2019 "Quantum Physical Unclonable Functions: Possibilities and Impossibilities", *Contributed talk at QCrypt 2019.*
- Jul 2019 "Quantum Emulation for Cryptanalysis", *Talk at Quantum Edi-Par workshop 2019, University of Edinburgh.*
- May 2019 "Quantum Physical Unclonable Functions", *Invited talk at LIP6 weekly Seminar, Sorbonne University, Paris.*
- May 2019 "Quantum Protocol Zoo", *Workshop talk at Quantum Internet Alliance (QIA) consortium, Lisbon.*
- Mar 2019 "A Quantum Protocol Zoo for Quantum Internet", *Talk at LFCS Security and Privacy Seminar, University of Edinburgh.*
- Aug 2021 "A Unified Framework For Quantum Unforgeability", *Poster presentation at QCrypt 2021.*
- Jul 2021 "Client-Server Identification Protocols with Quantum PUF", *Poster presentation at TQC 2021.*
- Feb 2021 "Variational Quantum Cloning: Improving Practicality for Quantum Cryptanalysis", *Poster presentation at QIP (Conference on Quantum Information Processing) 2021.*

Sep 2018 "Universal Superposition of Unknown Quantum States", *Poster presentation at IICQI (International Iran Conference on Quantum Information) 2018. - won Best poster award*

Outreach, Service, and Engagement Activities

- Podcast Guest in S2E11 of the insideQuantum podcast, ([Link to the episode](#))
- Public talk "From Quantum Computing to Quantum Mechanics: A journey backwards in time", *Public talk for Design Informatics, University of Edinburgh.* ([Link to the talk](#))
- Reviewer QCrypt conference, QIP conference, Nature Physics, npj Quantum Information, Advances in Mathematics of Communications, Quantum journal, ACM ToCL, PRA
- Miscellaneous "Head manager and organiser of *Music Festival of Physics Department, Sharif University of Technology*" for two years; "Member of the central council: *Scientific Society of Physics Department, Sharif University of Technology*"; Editorial Board of "Takaneh: The Student Journal of Physics", *Sharif University of Technology (2011-2013).*

Languages

- English Fluent
- French Advanced
- Farsi(Persian) Native