

Onur Pusuluk

PERSONAL INFORMATION

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APPOINTMENTS

Departments of Core Academics & Molecular Biology and Genetics, Kadir Has Univ., Istanbul, Turkey

Sep 2023 – present **Group Leader & Assistant Professor of Physics**

Department of Physics, Koç University, Istanbul, Turkey

Sep 2020 – Aug 2023 **Group Leader & Principal Investigator** on a quantum theoretical and computational chemistry programme on the resource value of biomolecular correlations from the standpoint of quantum information and thermodynamics. (Funder: The Scientific and Technological Research Council of Turkey, TRY 0.4 million for 3 years.)

Feb 2019 – Aug 2020, **Postdoctoral Research Assistant** on a project to investigate the role of quantum correlations in quantum thermodynamics in “*Quantum Enabling System Technologies Team*” (QuEST).

EDUCATION

Ph.D., Department of Physics, Istanbul Technical University, Turkey, 2018 (Thesis: “*Quantum aspects of molecular correlations in biological catalysis*”).

Recognized Ph.D. Student, Atomic & Laser Physics, University of Oxford, UK. 2014. “*The Frontiers of Quantum Physics group*” (supervised by Prof. Vlatko Vedral).

B.Sc., Department of Physics, Istanbul Technical University, Turkey, 2009 (Thesis: “*Quantum algorithms and the genetic code*”).

B.Sc., Department of Molecular Biology and Genetics, Istanbul Technical University, Turkey, 2006 (Thesis: “*Mathematical modelling of neuroimmunological interactions*”).

RESEARCH

Topics in Physics: Nonequilibrium quantum thermodynamics, quantum coherence/correlations in energy transfer and metrology, fermionic and non-Hermitian quantum information theory, quantum temporal correlations and emergence of classicality, time-symmetric quantum mechanics and indefinite causal structures.

Topics in Chemistry: Nature of chemical bonds and its quantumness, electron/proton delocalization and its coupling with molecular conformations, role of orbital correlations in (bio)chemical state transformations.

Topics in Biology: Biological function of hydrogen bonding, DNA replication, protein folding, magnetoreception, enzyme catalysis, and cognition.

Methods: Quantum information and computation, open quantum systems theory, single-shot quantum resource theories, post-Hartree-Fock methods, tensor networks and machine learning.

TEACHING & LEADERSHIP

Academic Supervisor, independent study projects on quantum information, quantum thermodynamics, and quantum biology for Ph.D., M.Sc., and B.Sc. students, Physics & MBG Departments.

Instructor, core program courses on fundamental sciences, quantum biology lectures at undergraduate and postgraduate levels at the Physics & MBG Departments, online quantum information and quantum biology courses for international high school and university students in Summer Research Programs.

Book Author, An Introduction to Quantum Bioscience (in preparation), Cambridge University Press & Assessment

Outreach. Involved in the initiation and organization of the nationwide schools outreach programmes such as [Mekansız Fizikçiler](#), [Fizik Haftası](#), [epiSTEM Türkiye](#), [Kuantum Türkiye](#), [Bilimler Köyü](#), and [The Society for the Purposefully Purposeless](#). Giving several short class sessions on various hot topics and current methods in quantum physics. Delivering popular science articles and live YouTube broadcasts in English/Turkish.

COMPUTING SKILLS

Languages: C, C++, Fortran, F, Python, MATLAB, Julia, and Mathematica.

Softwares: Post-HF calculations in Gaussian09, Molpro, Psi4, and PyScf; DMRG-SCF and DMRG-CI calculations in Psi4/CheMPS2 and PyScf/Block2.

Algorithms: Genetic Algorithms and Genetic Programming, Density Matrix Renormalization Group Algorithm (Basic), Restricted and Deep Boltzmann Machine Algorithms (Basic).

SELECTED PUBLICATIONS

U.5 Burkhard, M., **Pusuluk, O.**, Farrow, T. *Boosting biomolecular switch efficiency with quantum coherence.* [arXiv:2310.17585 \[quant-ph\]](#) (under review)

U.4 Yeşiller, M.H., **Pusuluk, O.** *Electron delocalization in aromaticity as a superposition phenomenon.* [arXiv:2307.00672 \[quant-ph\]](#) (under review)

U.3 Tırnak, Ö., Torun, G., **Pusuluk, O.** *Manipulating fermionic mode entanglement in the presence of superselection rules.* [arXiv:2303.04559 \[quant-ph\]](#) (under review)

U.2 **Pusuluk, O.** *Unified view of quantum superposition and quantum indistinguishability.* [arXiv:2210.02398 \[quant-ph\]](#) (under review)

U.1 **Pusuluk, O.**, Gedik, Z., Vedral, V. *Witnessing superpositions of causal orders by weak measurements at a given time.* [arXiv: 2209.09172 \[quant-ph\]](#) (under review)

J.9 Farhadi, N., **Pusuluk, O.**, 2024. *What is quantum in probabilistic explanations of the sure thing principle violation?* [BioSystems 238, 105180](#)

J.8 Gassab, L., **Pusuluk, O.**, Müstecaplıoğlu, Ö.E., 2024. *Geometrical optimization of spin clusters for the preservation of quantum coherence* [Phys. Rev. A 109, 012424](#)

J.7 Torun, G., **Pusuluk, O.**, Müstecaplıoğlu, Ö.E., 2023. *A compendious review of majorization-based resource theories: quantum information and quantum thermodynamics* [Turk. J. Phys. 47 \(4\), 141–182](#)

J.6 **Pusuluk, O.**, Yeşiller, M.H., Torun, G., Müstecaplıoğlu, Ö.E., Yurtsever, E., Vedral, V., 2022. *Classical and quantum orbital correlations in molecular electronic states.* [New J. Phys. 24, 102001.](#)

J.5 Pedram, A., **Pusuluk, O.**, Müstecaplıoğlu, Ö.E., 2022. *Quantum correlations in Jahn-Teller molecular systems simulated with superconducting circuits.* [J. Phys.: Conf. Ser. 2191, 012018.](#)

J.4 **Pusuluk, O.**, Müstecaplıoğlu, Ö.E., 2021. *Quantum Rayleigh problem and thermocoherent Onsager relations.* [Phys. Rev. Research 3, 023235.](#)

J.3 **Pusuluk, O.**, Farrow, T., Deliduman, C., and Vedral, V., 2019. *Emergence of correlated proton tunneling in water ice.* [Proc. R. Soc. A 475 \(2225\): 20180867.](#)

J.2 **Pusuluk, O.**, Farrow, T., Deliduman, C., Burnett, K., and Vedral, V., 2018. *Proton tunneling in hydrogen bonds and its possible implications in an induced-fit model of enzyme catalysis.* [Proc. R. Soc. A 474 \(2218\): 20180037.](#)

J.1 **Pusuluk, O.**, Torun, G., Deliduman, C., 2018. *Quantum entanglement shared in hydrogen bonds and its usage as a resource in molecular recognition.* [MPLB 32 \(26\): 1850308.](#)

O.1 **Pusuluk, O.** and Deliduman C., 2011. *Entanglement swapping model of DNA replication.* [arXiv: 1101.0073 \[quant-ph\].](#)