Ömer Ünlüsoy

Address	Ankara, Türkiye
Email	omer.unlusoy@ens.psl.eu
Phone	+90 542 417 38 04, +33 7 53 49 27 95
Profiles	omerunlusoy, azizsoysuz

Education

Master of Science (MSc) | ***Physics, ICFP Theoretical Physics Track*** 2023 – 2025
École Normale Supérieure - PSL Paris, France
M2 ICFP Grade: 12.44/20, M1 ICFP Grade: 12.89/20, PSL Excellence Fellowship

Bachelor of Science (BSc) | ***Physics*** 2019 – 2023
Bilkent University Ankara, Türkiye
GPA: 3.48/4.0, Comprehensive (100%) Scholarship, Magna Cum Laude, 6 High Honours & 2 Honours

Bachelor of Science (BSc) | ***Computer Engineering*** 2018 – 2023
Bilkent University Ankara, Türkiye
GPA: 3.60/4.0, Comprehensive (100%) Scholarship
ranked 814th in the ÖSYM university entrance exam amongst 2.2 million students

Languages

Turkish: Native
English: Fluent (IELTS: 7.5)

Programming Skills

Advanced: Python (QuTiP, Qiskit, cryptography, PyTorch), C++, C, Java, Mathematica, Git, LaTeX
Basic: Swift, SQL, PHP, UML

Experience

M2 Internship on Tripartite Vacuum State of the Causal Diamond | ***Bilkent University (remote)*** April – June 2025
Research Advisor: Prof. Ali Ulvi Yılmazer Paris, France
I derived the tripartite vacuum state of the tripartite Diamond coordinates and showed that the diamond temperature is frequency-dependent. Furthermore, I demonstrated the entanglement degradation for the diamond observers with three entanglement measures: the Peres-Horodecki criterion, logarithmic negativity, and quantum mutual information.

M1 Internship on Unruh Effect in Tripartite Diamond Coordinates | ***LPENS*** March – July 2024
Research Advisor: Dr. Giuseppe Policastro Paris, France
I proposed a conformal transformation to obtain a tripartite formulation of Diamond coordinates that separates the three wedges. I calculated the 6 Bogoliubov coefficients, demonstrated the Unruh effect, and derived the diamond and Unruh temperatures for the two-dimensional massless scalar field.

Senior Thesis on Non-Abelian Gauge Theories | ***Bilkent University*** February – June 2023
Research Advisor: Prof. Ali Ulvi Yılmazer Ankara, Türkiye
As the second part of my senior thesis, I worked on the theoretical explanation of non-abelian gauge theories describing fundamental interactions. I mainly benefited from Peskin's book.

Senior Thesis on Spontaneous Symmetry Breaking and Higgs Mechanism | ***Bilkent University*** Aug 2022 – Feb 2023
Research Advisor: Prof. Ali Ulvi Yılmazer Ankara, Türkiye
I worked on the theoretical explanation of spontaneous symmetry breaking and the Higgs mechanism in the quantum-mechanical (QM) framework. I mainly benefited from Griffiths and Halzen & Martin's textbooks.

Internship on Physics-Informed Neural Networks | ***Roketsan*** June – July 2021
Research Advisor: Assoc. Prof. Umut Demirezen Ankara, Türkiye
I worked on numerical solutions of the nonlinear Schrödinger equation and Burgers' equation using physics-informed neural networks (PINN) with the PyTorch library.

Computer Engineering Senior Project on Neural Pollen Classification | ***Bilkent University*** Sep 2021 – June 2022
Research Advisor: Dr. A. Ercüment Çiçek Ankara, Türkiye
I was the project leader of a group that worked on pollen detection and classification under a light microscope with convolutional neural networks. We prepared the dataset from scratch with the help of R.A. Aydan Acar, Ankara University. The project received the Data Science Award of CS Fair '22 from Yapı Kredi Technologies.

Internship on iOS App Development | ***Layermark (remote)*** July – September 2020
Project Leader: Yücel Tepeköy Washington, D.C., USA
I contributed to migrating a legacy Windows-based GIS application to iOS, developing the new Swift implementation using Esri's ArcGIS framework with Realm, Alamofire, and Eureka integrations.

Relevant Courses

Master's in Physics | ***ICFP Physics***

Quantum Field Theory I and II, Conformal Field Theory, Phenomenology of the Standard Model and Beyond, Lie Groups Lie Algebras and Representations, Advanced Statistical Physics and New Applications, General Relativity, Quantum Information, Machine Learning, Relativistic Quantum Mechanics and Introduction to QFT, Introduction to General Relativity, Symmetries in Physics, Quantum Optics, Cosmology, Climate Physics, Library-based Project (on $SU(5)$ Grand Unification)

Bachelor of Science | ***Physics***

Nuclear and Particle Physics, Quantum Measurements and Sensing (graduate-level course), Quantum Optics (graduate-level course), Introduction to Quantum Computation (graduate-level course), Condensed Matter Physics I

Bachelor of Science | ***Computer Engineering***

Machine Learning, Artificial Intelligence, Automata Theory and Formal Languages, Signals and Systems, Operating Systems, Database Systems, Computer Networks, Number Theory, Algorithms, Object-Oriented Software Engineering

Projects

Signal Protocol for End-to-End Messaging April – June 2025

I implemented the X3DH key agreement protocol and the Double Ratchet algorithm of the Signal protocol in Python. I built a minimal client-database CLI for end-to-end messaging that employs SHA-256, Argon2id, AES-256, HMAC, and an encrypted SQLite backend.

Image Style Transfer Using CNNs | ***ENS - PSL*** January – March 2025
Project Advisor: Prof. Marc Lelarge Paris, France
We worked on the image style transfer method of Leon A. Gatys et al. and improved our previous results with experiments on the ratio α/β, content and style layer selection, and content and style layer weights.

Library-based Project on SU(5) Grand Unification | ***ENS - PSL*** September 2023 – February 2024
Research Advisor: Prof. Raffaele Tito D'Agnolo Paris, France
I worked on the Georgi-Glashow model of $SU(5)$ and how that Lie group can spontaneously be broken into the Standard Model $SU(3) \otimes SU(2) \otimes U(1)$ product group. I have derived $\mathfrak{su}(3)$ Lie algebra representations and showed how $SU(5)$ representations can be decomposed via Young tableau to cover the Standard Model.

Review and Simulation of Quantum State Tomography Experiments | ***ENS - PSL*** September 2023 – January 2024
Project Advisor: Assoc. Prof. Pierre-Francois Cohadon Paris, France
We reviewed Mlynek-Breitenbach-Schiller's squeezed-light and homodyne tomography experiments, analyzed the optical parametric amplifier setup, and reproduced the idealized squeezed-state dynamics with QuTiP. We computed higher-order moments and reconstructed theoretical Wigner functions via inverse Radon transforms.

Analysis and Simulation of Weak Values in Two-State Vector Formalism | ***Bilkent University*** January – May 2023
Project Advisor: Prof. Ceyhun Bulutay Ankara, Türkiye
We reviewed the two-state vector formalism of the Aharonov-Bergmann-Lebowitz framework, which is a time-symmetric formalism of quantum states and measurements. We reproduced weak-value shifts in von Neumann-type measurements and worked through explicit examples (Stern-Gerlach spin measurement, polarization optics, Sagnac interferometer) to analyze weak-value amplification and direct wavefunction measurement schemes.

Monte Carlo Simulation on Gauge Theories | ***Bilkent University*** September 2022 – January 2023
Project Advisor: Prof. Yiğit Gündüç Ankara, Türkiye
I worked on Z_2 lattice gauge theory, in which strong interactions are simulated with a non-perturbative approach using Monte Carlo simulations.

Neural Style Transfer of Paintings to Selfies | ***Bilkent University*** September 2021 – January 2022
I was the project leader of a group that worked on neural style transfer of selfies to paintings with convolutional neural networks (mainly VGG-19) with the PyTorch library.

Crosswind – AI Crossword Puzzle Solver | ***Bilkent University*** January – May 2021
I contributed to developing a Python-based AI puzzle solver for The New York Times Mini Crossword, combining web scraping, NLP-based candidate generation, constraint satisfaction, and a custom DFS search algorithm to select optimal solutions.

Sapientia Online Course Platform | ***Bilkent University*** January – May 2021
I was the project leader of a group that worked on a web-based Course Platform. I directed the backend and database design for the platform, from ER modeling and schema definition to SQL query implementation and several dynamic PHP pages.

Bilpoly Computer Game | ***Bilkent University*** September 2020 – January 2021
I was the project leader of a group that worked on a JavaFX-based custom Monopoly game. I designed the game-logic subsystem, including entity classes, turn execution logic, pawn-movement mechanics, and backend-UI integration.

FELLOWSHIPS

PSL Excellence Fellowship | ***École Normale Supérieure - PSL*** September 2023 – July 2025
Merit-based scholarship for my master's studies in physics

Cité Internationale Merit Scholarship | ***Cité Internationale Universitaire de Paris*** September 2024 – July 2025
Merit-based scholarship covering accommodation for the second year of my master's studies

French Embassy - TEV Scholarship | ***French Embassy in Türkiye*** September 2023 – June 2024
French-government-supported merit-based scholarship for the first year of my master's studies

Bilkent Comprehensive Scholarship | ***Bilkent University*** September 2018 – June 2023
Merit-based full (100%) scholarship covering tuition, accommodation, and a monthly stipend

TÜBİTAK National Undergraduate Scholarship | ***TÜBİTAK*** September 2019 – June 2023
Merit-based scholarship from the Scientific and Technological Research Council of Türkiye

Çekirdekçiler Scholarship | ***Çekirdekçiler A.Ş.*** September 2018 – June 2023
Merit-based scholarship for my ranking in the ÖSYM university entrance exam

EXTRACURRICULAR ACTIVITIES

Social Projects
I have taken an active part in several social projects aimed at introducing engineering and science to high-school students in less privileged areas, such as Mobile Days '17, CS Fair '17, Üniversiteye Doğru '19, VOL-E.

Aikido
4^{th} Kyu Aikido practitioner.

Hiking and Camping
I enjoy regularly hitchhiking along the western coast of Türkiye for wild camping and hiking.