Burak Oğuz

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About me

A theoretical physics post-graduate student at ICTP. Aspiring to contribute towards a concrete formulation of Quantum Field Theory (QFT).

Education

ICTP Post-Graduate Diploma Program Sep. 2025 - Present
Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy

- Thesis topic: Aspects of conformal defects in O(N) models
- Supervisor: Dr. Gabriel Cuomo (SISSA) (academic webpage)

Bachelor of Science in Physics (GPA: 3.65/4.0) Aug. 2021 - Jun. 2025
Middle East Technical University (METU), Ankara, Turkey

- Thesis: Bootstrapping non-invertible symmetries (poster & slides)

Publications

Oğuz, B., Topological manipulations on $\mathbb{R}$ symmetries of Abelian gauge theory. J. High Energ. Phys. 2025, 135 (2025), [2505.03700].

Oğuz, B., and Tekin, B. Some lower dimensional quantum field theories reduced from Chern-Simons gauge theories. *Phys. Rev. D*, 110 (2024) 085019, [2405.09473].

Research Experiences

Defects in Conformal Field Theory Sep. 2025 – Present
Supervisor: Dr. Gabriel Cuomo (SISSA)

- Reproduced perturbative results in critical O(N) model with a defect insertion.
- Investigating properties of critical (spinning) impurities and their phases.

Topological Aspects of Non-Compact Gauge Theories Jan. 2025 – Oct. 2025
Independent work

- Contributed to the study of topological manipulations on non-compact symmetries, building on recent developments concerning non-compact TQFTs.
- Bridged the SymTFT results in the literature with local TQFT couplings, and explored novel manipulations and topological defects.

2d Adjoint Quantum Chromodynamics (QCD) Jun. 2025 - Aug. 2025
Supervisor: Prof. Mithat Ünsal (NCSU)

- Through the lens of non-abelian bosonization, studied the dynamics and non-invertible symmetries of 2d QCD with adjoint fermionic matter fields.

Research Group on Gauge/Gravity Theories July 2023 – Dec. 2024
Mentor: Prof. Bayram Tekin (METU)

- Contributed to the dimensional reduction of Chern-Simons theory and 3d gravity.

Organizational Work

Quantum Theories of Fields, Matter, and Strings Apr. 2025 - Present

- Founder and organizer of an online seminar series on theoretical physics (QTFMS).
- Run by a group of students, with a reach of thousands of people across the globe.
- Hosted 20+ technical talks by excellent researchers over the course of 6 months.

Talks & Presentations

Topological Manipulations And Duality In QFT Apr. 24, 2025
Invited speaker at the QDIS22 Conference (website).
Gebze Technical University, Istanbul, Turkey

Bootstrapping Non-Invertible Symmetries Jan. 13, 2025
Poster session and presentation for the PHYS400 course at METU (poster & slides).

RCFT & Verlinde Operators Sep. 1, 2024
Directed Reading Program Symposium 2024 (website, talk recording).
Sabancı University, Istanbul, Turkey

Dimensional Reduction of Chern-Simons Theory May 16, 2024
Departmental seminar at METU.

Teaching Experiences

- Gave lectures on "Generalized Symmetries" in METU Aug. 2024 - Sep. 2024
- Gave lectures on "Topological Solitons" in METU Feb. 2024 - Mar 2024
- Gave lectures on "Yang-Mills Instantons" in METU Nov. 2024 - Dec. 2024

Awards & Honors

- Was awarded a 1-year fellowship by ICTP.
- 500$ publication reward from Prof. Bayram Tekin's fund.
- 430$ ($\approx$ 18,018 Turkish liras) publication reward from TÜBİTAK (UBYT).

Projects

Josephson Junction and QED$_3$ (project files) Nov. 2024 - Dec. 2024

RCFT & Verlinde Operators (project files) July 2024 - Aug. 2024

Seiberg-Witten Theory (project files) Mar. 2024 - June 2024

Relevant Coursework

Specialized Lectures (not in the transcript):
"**Geometric Quantization**" by Asst. Prof. İlker Berktav May 2024 - Oct. 2024
"**Physics of Fuzzy Spheres**" by Prof. Dr. Seçkin Kürkçüoğlu Mar. 2024 - May 2024

Graduate Level: Quantum Field Theory (I-II), Bootstrap Methods (I), Many-Body Systems (I), Gravitation and Cosmology (I), Quantum Mechanics (I).

Undergraduate Level: Particle Physics (I-II), Relativity (I-II), Quantum Mechanics (I-II), Classical Mechanics (I-II), Electromagnetic Theory (I-II), Python Coding, Calculus (I-II), Linear Algebra, Differential Equations, Complex Calculus.

Skills

- Programming languages: Python, Mathematica, Matlab
- Operating systems: Linux (ubuntu)
- Software: LaTeX, Git
- Languages: Turkish (native), English(C1), French(B1), Italian(A1), Russian(A1)

Outreach Activities

- At **Ankara METU Development Foundation Private Schools**, delivered eight-hour lectures on physics to four high school Olympic students in May 2023.
- At the METU **Physics Society**, volunteered in a two-day outreach workshop in May 2022 with around 100 participants from diverse backgrounds.

References **(alphabetical order)**

Prof. Bobby Acharya (ICTP),
Dr. Gabriel Cuomo (SISSA),
Prof. Mithat Ünsal (NCSU).