Ibrahim Kecoglu

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Summary

I graduated from Bogazici University with a double major in Physics and Mathematics in June 2024. Since completing high school, I have actively engaged in theoretical and experimental research. Under the guidance of Prof. A. Nihat Berker, my research has focused on spin-glasses, phase transitions, and renormalization group theory. Additionally, I have had the opportunity to work with Prof. M. Burcin Unlu at BUMILAB, a photonics and biomedical physics laboratory at Bogazici. In this role, I have been involved in Raman spectroscopy, biomedical imaging, and optical tweezers. I have also utilized spectral analysis and machine learning in my experimental work. Currently, I am a first-year PhD student in Biomedical Physics at Stanford University. I am passionate about advancing the intersection of physics, mathematics, and biomedicine to drive innovation in healthcare technologies.

Research Experience

Molecular Imaging Instrumentation Laboratory - PhD Lab Rotation Jan. 2025 - Present
Supervisor: Craig Levin, Stanford University

- Working on developing a diffusion model for generating super-resolution PET images from conventional PET data.

Durmus Lab - PhD Lab Rotation Sep. 2024 - Dec. 2024
Supervisor: Gozde Durmus, Stanford University

- Developed a simulation to study cell aggregation within an oscillating field maglev device.
- Characterized the effects of various surface treatment protocols on the performance of SERS substrates.
- Utilized SERS for the detection of exosomes.
- Gained hands-on wet lab experience, including working in a biosafety cabinet, passaging cell lines, and performing cell counting.

Medical and Biological Physics Laboratory - Undergraduate Researcher Aug. 2019 - June 2024
Supervisor: Mehmet Burcin Unlu, Bogazici University

- Designed and built scanning Raman spectroscopy, optical tweezer, and microscopy setups.
- Worked with various biological samples, such as animal tissues, blood samples, plant tissues, and even nano-scale vesicles like exosomes.
- Created a code library for preprocessing Raman spectra, including calibration and base correction in MATLAB.
- Analyzed spectral data using spectral analysis methods like band component analysis and created statistical and machine learning models using MATLAB and Python.
- Learned sample preparation techniques like isolating exosomes from cellular media.
- Published seven research articles in peer-reviewed journals.

Berker Research Group - Undergraduate Researcher Mar. 2020 - June 2024

Supervisor: Ahmet Nihat Berker, MIT & KHAS University

- Worked with a variety of models, such as Ising, Potts, and Ashkin-Teller models.
- Characterized phases of such systems and the transitions.
- Used methods like renormalization group theory, duality transformation, the transfer matrix method, the Migdal-Kadanoff approximation, multifractal analysis, and more.
- Developed a new approach to classifying the chaotic behavior of real-life systems.
- Published three peer-reviewed articles.

Teaching Experience

KHAS University Summer/Winter School - Teaching Assistant July 2019 - June 2024

- Served as a teaching assistant for several open courses on the subjects of quantum mechanics, electricity and magnetism, and statistical mechanics under the guidance of Prof. A.N. Berker.

Education

2020 - 2024 BS, Physics at **Bogazici University** (GPA: 3.79/4.00, High Honors, 2nd Place)
2022 - 2024 BS, Mathematics at **Bogazici University** (GPA: 3.79/4.00, High Honors)
2024 - 2029 PhD, Biomedical Physics at **Stanford University**

Language Skills

I am native in Turkish, and I have academic proficiency in English. I also have experience writing academic research articles in English.

Awards & Scholarships

EpiSTEM - 1st Place Apr. 2019

EpiSTEM was a nationwide research project competition for high schoolers where we designed, proposed, and executed a research project. As a group of three students, we built a DIY spectrometer, and using it, we investigated the effect of the storage surface on the decomposition of fruits.

TUBITAK 2205 - Undergraduate Scholarship Program Sep. 2019 - June 2024

This scholarship is awarded to those students who were in the first 25 thousand among approximately two million students who entered the nationwide university placement test and decided to study in a STEM program.

Licenses & Certifications

July 2020 - Introduction to Molecular Biology and Genetics Engineering at **Kadir Has University**
July 2020 - Social and Physical Networks, Complex Systems, Chaos and Control at **Kadir Has University**
Feb. 2020 - Phase Transitions and Renormalization Group at **Kadir Has University**
July 2019 - Big Data - Intelligent Data: You Too Can Create It, Manage It at **Kadir Has University**
July 2019 - Introduction to Computer Engineering at **Kadir Has University**
July 2018 - Introduction to Quantum Mechanics at **Kadir Has University**

Publications

[1] **Ibrahim Kecoglu** and A. Nihat Berker. "Across dimensions: Two- and three-dimensional phase transitions from the iterative renormalization-group theory of chains". In: *Physical Review E* 102.3 (Sept. 2020), p. 032134. ISSN: 2470-0045, 2470-0053. DOI: 10.1103/PhysRevE.102.032134.

[2] Bukem Tanoren, Ugur Parlatan, Melita Parlak, **Ibrahim Kecoglu**, Mehmet Burcin Unlu, Didem Melis Oztas, Mustafa Ozer Ulukan, Korhan Erkanli, and Murat Ugurlucan. "Aortic aneurysm evaluation by scanning acoustic microscopy and Raman spectroscopy". In: *Analytical Methods* 13.39 (Sept. 2021), pp. 4683–4690. ISSN: 1759-9660, 1759-9679. DOI: 10.1039/D1AY01133B.

[3] Ugur Parlatan, Seyma Parlatan, Kubra Sen, **Ibrahim Kecoglu**, Mustafa Ozer Ulukan, Atalay Karakaya, Korhan Erkanli, Halil Turkoglu, Murat Ugurlucan, Mehmet Burcin Unlu, and Bukem Tanoren. "Atrial fibrillation designation with micro-Raman spectroscopy and scanning acoustic microscope". In: *Scientific Reports* 12.1 (Apr. 2022), p. 6461. ISSN: 2045-2322. DOI: 10.1038/s41598-022-10380-z.

[4] **Ibrahim Kecoglu**, Merve Sirkeci, Mehmet Burcin Unlu, Ayse Sen, Ugur Parlatan, and Feyza Guzelcimen. "Quantification of salt stress in wheat leaves by Raman spectroscopy and machine learning". In: *Scientific Reports* 12.1 (May 2022), p. 7197. ISSN: 2045-2322. DOI: 10.1038/s41598-022-10767-y.

[5] Irem Loc, **Ibrahim Kecoglu**, Mehmet Burcin Unlu, and Ugur Parlatan. "Denoising Raman spectra using fully convolutional encoder–decoder network". In: *Journal of Raman Spectroscopy* 53.8 (Aug. 2022), pp. 1445–1452. ISSN: 0377-0486, 1097-4555. DOI: 10.1002/jrs.6379.

[6] Ayse SEN, **Ibrahim Kecoglu**, Muhammad Ahmed, Ugur Parlatan, and Mehmet Burcin Unlu. "Differentiation of advanced generation mutant wheat lines: Conventional techniques versus Raman spectroscopy". In: *Frontiers in Plant Science* 14 (Feb. 2023). ISSN: 1664-462X. DOI: 10.3389/fpls.2023.1116876.

[7] E. Can Artun, **Ibrahim Kecoglu**, Alpar Türkoğlu, and A. Nihat Berker. "Multifractal spin-glass chaos projection and interrelation of multicultural music and brain signals". In: *Chaos, Solitons & Fractals* 167 (Feb. 2023), p. 113005. ISSN: 0960-0779. DOI: 10.1016/j.chaos.2022.113005.

[8] Ugur Parlatan, Mehmet Ozgun Ozen, **Ibrahim Kecoglu**, Batuhan Koyuncu, Hulya Torun, Davod Khalafkhany, Irem Loc, Mehmet Giray Ogut, Fatih Inci, Demir Akin, Ihsan Solaroglu, Nesrin Ozoren, Mehmet Burcin Unlu, and Utkan Demirci. "Label-Free Identification of Exosomes using Raman Spectroscopy and Machine Learning". In: *Small* 19.9 (Mar. 2023), p. 2205519. ISSN: 1613-6829. DOI: 10.1002/smll.202205519.

[9] Arda Inanc, Nayce Ilayda Bektas, **Ibrahim Kecoglu**, Ugur Parlatan, Begum Durkut, Melike Ucak, Mehmet Burcin Unlu, and Ciler Celik-Ozenci. "Label-free differentiation of functional zones in mature mouse placenta using micro-Raman imaging". In: *Biomed. Opt. Express* 15.5 (May 2024), pp. 3441–3456. DOI: 10.1364/BOE.521500. URL: https://opg.optica.org/boe/abstract.cfm?URI=boe-15-5-3441.

[10] **Ibrahim Kecoglu** and A. Nihat Berker. "Global Ashkin–Teller phase diagrams in two and three dimensions: Multicritical bifurcation versus double tricriticality - endpoint". In: *Physica A: Statistical Mechanics and its Applications* (Oct. 2023), p. 129248. ISSN: 0378-4371. DOI: https://doi.org/10.1016/j.physa.2023.129248.