Mehmet Burcin Unlu

Dean & Professor, Faculty of Aviation and Aerospace Sciences · Faculty of Engineering
Özyeğin University, Çekmeköy, Istanbul, Turkey

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RESEARCH FIELDS & EXPERTISE

Computational Physics	Modeling, Image Reconstruction Algorithms, Physical Cancer Modeling, Computational Medicine
Biomedical Physics & Imaging	Photo-acoustics, Optical Tomography, Ultrasound, Scanning Acoustic Microscopy, Raman Spectroscopy

ACADEMIC APPOINTMENTS

Dean, Faculty of Aviation and Aerospace Sciences — September 2023 – Present
Özyeğin University, Çekmeköy, Istanbul, Turkey

Professor, Faculty of Engineering — September 2023 – Present
Özyeğin University, Çekmeköy, Istanbul, Turkey

Professor of Physics — June 2017 – September 2023
Boğaziçi University, Bebek, Istanbul, Turkey

▷ Chair, Department of Physics (2018–2020 & 2022–2023)

Collaborative Researcher (Part-time) — August 2018 – Present
Hokkaido University, Sapporo, Japan

Visiting Professor (Full-time) — February 2018 – August 2018
Hokkaido University, Sapporo, Japan

Visiting Scholar — August 2017 – August 2018
Laboratory of Artificial Intelligence for Medicine and Biomedical Sciences, Radiation Oncology, Stanford University School of Medicine, CA, USA

Associate Professor of Physics — 2011 – 2017
Boğaziçi University, Bebek, Istanbul, Turkey

Assistant Professor of Physics — 2010 – 2011
Boğaziçi University, Bebek, Istanbul, Turkey

Assistant Project Scientist — 2007 – 2009
Center for Functional Oncolmaging, University of California, Irvine, CA, USA

Postgraduate Researcher — 2004 – 2007
Center for Functional Oncolmaging, University of California, Irvine, CA, USA

EDUCATION

PhD in Physics — 2000 – 2004
Stevens Institute of Technology, Hoboken, NJ, USA

MS in Physics — 1996 – 1998
Boğaziçi University, Istanbul, Turkey

BS in Physics — 1992 – 1996

Middle East Technical University, Ankara, Turkey

HONORS & AWARDS

Fulbright Visiting Scholar Fellowship 2017–2018

Excellence in Teaching Award 2017
Boğaziçi University, Istanbul, Turkey

Excellence in Teaching Award 2013
Boğaziçi University, Istanbul, Turkey

RESEARCH FUNDING

Ongoing

TÜSEB 2025-B-01 #44634 (Unlu, PI) Integrated Photoacoustic and Magnetic Levitation Device for Microrobots April 2025

TÜSEB 2025-A2-01 #46742 (Unlu, Thesis Supervisor; Student: Burak Arayıt) Photoacoustic Tracking of Moving Organisms Inside a Phantom Using a Quantum Cascade Laser March 2025

TÜSEB 2025-A1-01 #46021 (Unlu, Research Supervisor; Student: Elif Başak Şişman) Development of a Tactile Feedback Glove for Advanced Tissue Differentiation in Tumors January 2025

TÜSEB 2025-A1-01 #44296 (Unlu, Research Supervisor; Student: Aslı Özman) Investigation of Photothermal Properties of Silver Nanoparticle-Loaded Transdermal Films January 2025

TÜSEB 2024-B-01 #39866 (Unlu, Research Supervisor; Student: Defne Yılmaz) Investigation of Potential Effects of Chemotherapy on the Fetus Using Raman Spectroscopy and Machine Learning April 2024

TÜBİTAK 1004 (Unlu, Co-PI) Development of Catheter-Based Photoacoustic Imaging System for Prostate Cancer

TÜBİTAK 1001 #323K345 (Unlu, PI) Quantum Technologies Training for Teachers 2024–2027

TÜBİTAK 1001 #124M687 (Unlu, PI) Label-Free Characterization of Cells and Exosomes in Diagnosis and Monitoring of Muscle and Tendon Injuries in Athletes Using Raman Spectroscopy and Magnetic Levitation 2024–present

TÜBİTAK 1001 #124F389 (Unlu, Advisor) Investigation of Photoacoustic Wave Emission Properties of Metal-Coated Janus Particles by Optical and Magnetic Methods 2025–2028

TÜBİTAK 1001 #123S661 (Unlu, Researcher) Investigation of the Role of Circadian Rhythm in Uterine Pregnancy Function, Placental Development, and Intrauterine Growth Restriction via Per1/Per2 Double Knockout Mouse Model 2023–2026

TÜBİTAK 1004 #22AG016 (Unlu, Researcher) Neurotechnological Solutions Platform Against Threats to Human Function 2023–2027

TÜBİTAK 3501 #124F110 (Unlu, Advisor) Numerical Modeling of Dark and Transient Electronic State Transitions of Fluorophores and Fluorescent Biomolecules with Microfluidic-Based Fluorescence Spectroscopy 2024–2026

TÜBİTAK 3501 #124F275 (Unlu, Advisor) Mathematical Modeling of Extracellular Matrix-Targeting Treatments in Solid Tumors and Computational Investigation of Anticancer Effects of Therapeutic Agents 2024–2026

TÜBİTAK 3501 #124Z990 (Unlu, Advisor) Optimum Biomimetic Hydrogel Scaffold Design for Triple Breast Cancer and Drug Testing 2025–2028

TÜBİTAK SAYEM (Unlu, Co-PI) with VSY Biotechnology Development of a New Generation High Stabilization Hydrophobic Intraocular Lens with Sinusoidal Optical Design Integrated with a Preloaded Injector System

NATO (Unlu, Co-PI) DeeP-MaRS: An AI-Assisted Bioweapon Detection Platform

Completed — TÜBİTAK (PI)

TÜBİTAK 1003 #118S113 (Unlu, PI) Development of Catheter-Based Photoacoustic Imaging System for Prostate Cancer 2018–2021

TÜBİTAK 1003 #213E033 (Unlu, PI) Optical Tweezers-Based Photoacoustic Microscope for Cancer Pathology 2015–2018

TÜBİTAK 1001 #119F319 (Unlu, PI) Investigation of Nanoparticle Contributions to Photon/Proton Therapy Using Acoustic and Photoacoustic Microscopy 2020–2023

TÜBİTAK 1001 #117F407 (Unlu, PI) Physical Modeling of Combining Anti-Angiogenic Drugs with Hadron Therapy and Chemotherapy to Optimize Cancer Treatment Benefit 2018–2020

TÜBİTAK 1001 #113F047 (Unlu, PI) An Original Physical Model of Drug Delivery in Cancer Tumors 2013–2015

Completed — TÜBİTAK (Advisor/Researcher)

TÜBİTAK 1001 #119E624 (Unlu, Advisor) Development of a Photoacoustic Tomographic Imaging Method for Skin Cancer Diagnosis 2020–2023

TÜBİTAK 1001 #118Z984 (Unlu, Advisor) Investigation of Potential and Physiological Effects of *Piriformospora Indica* as a Biological Agent Against Boron Toxicity in Wheat 2019–2022

TÜBİTAK 1001 #117F464 (Unlu, Advisor) Setup of High-Resolution Photoacoustic Microscopy System Using Thulium-Based Lasers at 2-Micron Wavelength and Dermatological Applications 2018–2021

TÜBİTAK 1001 #117E991 (Unlu, Advisor) Minimally Invasive Activation of Ovarian Follicles in Premature Ovarian Insufficiency Using a Femtosecond Laser System 2018–2020

Completed — International

NATO (Unlu, PI) Standoff Coherent Detection of Warfare Chemicals via Photoacoustic Spectroscopy

H2020-MSCA-ITN-2018 (Unlu, Co-PI) Active Matter: From Fundamental Science to Technological Applications

Turkish Ministry of Development 2015BSV247 (Unlu, PI) Development of Multimodal Biomedical Microscopy Systems & Molecular Imaging Laboratory (3M-Lab)

British Council – Newton Fund 216415519 (Jones-PI, UCL; Unlu, Co-PI) Manipulation and Destruction of Cancer Cells Using Cavitation Bubbles by Optical and Acoustic Tweezers

Marie Curie International Reintegration Grant PIRG07-GA-2010-268287 (Unlu, PI) DOT/MRI Dual-Modality Cancer Imaging Using a Bifunctional Contrast Agent

Completed — USA (NIH)

P30 CA-104548 (Nalcioglu, PI; Unlu, Postgraduate Researcher) Combined MR-Diffuse Optics for Functional Imaging, PHS/NIH National Cancer Institute 2004–2009

R21 CA120175 (Gulsen, PI; Unlu, Investigator 15%) Development of a Multi-Modality System for Onco-Imaging, NIH/NCI 2007–2011

R21 CA121568 (Su, PI; Unlu, Postgraduate Researcher 20%) Combined MRI and Optical Imaging to Improve Breast Cancer Diagnosis, NIH/NCI 2007–2009

PATENTS

Gulsen, G., Thayer, D., Yuting, L.I.N. and **Unlu, M.B.**, The Regents of The University of California, 2015. *Method and Apparatus for Photomagnetic Imaging.* **U.S. Patent 9,078,587**.

SELECTED PUBLICATIONS (2020–2025)

1. Pesen, T., Akgun, B., **Unlu, M.B.** "Measuring the effect of repetitive stretching on the deformability of human red blood cells using optical tweezers." **Scientific Reports 15**(1), 9060 (2025).

2. Khoshzaban, A., Magazzú, A., Donato, M.G., Maragò, O.M., **Unlu, M.B.** "Dynamics of Pulsed-Laser Interaction with Janus Particles." **ACS Photonics 12**(4), 1936–1943 (2025).
3. Chen, Y., Kasamatsu, K., Kuriyama, Y., Uesugi, T., Ishi, Y., Murakami, T., **Unlu, M.B.** "Accuracy verification of protoacoustic measurements in a heterogeneous phantom by an optical hydrophone." **Medical Physics 52**(3), 1893–1902 (2025).
4. Ramarao, M., Ozaltin, A., Yaman, S., Ozbozduman, K., Loc, I., Ertok, N., Gao, A., **Unlu, M.B.** "3D-Printed Magnetic Levitation Device with Deep Learning-Assisted Particle Tracking and Analysis for High-Throughput Sorting." **bioRxiv** 2025.01.15.633098 (2025).
5. Demir, M., Çizmeciyan, M.N., Sipahioğlu, D., Khoshzaban, A., Ünlü, M.B., et al. "Portfolio of colloidally stable gold–gold sulfide nanoparticles and their use in broad-band photoacoustic imaging." **Nanoscale 17**(3), 1371–1380 (2025).
6. Cizmeciyan, M.N., Bektas, N.I., Derin, N., Denizaltı, T., Khoshzaban, A., **Unlu, M.B.**, et al. "Unveiling placental development in circadian rhythm-disrupted mice: A photo-acoustic imaging study on unstained tissue." **Placenta 158**, 57–61 (2024).
7. Modregger, P., Khosla, M., Chakrabarti, P., Ozturk, O., Spiers, K.M., **Unlu, M.B.** "Calibration of scanning acoustic microscopy for the differentiation between unstable and stable atherosclerotic plaques by X-ray fluorescence imaging." **Radiation Physics and Chemistry 224**, 112058 (2024).
8. Loc, I., **Unlu, M.B.** "Accelerating photoacoustic microscopy by reconstructing undersampled images using diffusion models." **Scientific Reports 14**(1), 16996 (2024).
9. Sueyasu, S., Kasamatsu, K., Takayanagi, T., Chen, Y., Kuriyama, Y., Ishi, Y., **Unlu, M.B.**, et al. "Application of an optical hydrophone to ionoacoustic range detection in a tissue-mimicking agar phantom." **Medical Physics 51**(7), 5130–5141 (2024).
10. Ozbozduman, K., Loc, I., Durmaz, S., Atasoy, D., Kilic, M., Yildirim, H., Esen, T., **Unlu, M.B.** "Machine learning prediction of Gleason grade group upgrade between in-bore biopsy and radical prostatectomy pathology." **Scientific Reports 14**(1), 5849 (2024).
11. Inanc, A., Bektas, N.I., Kecoglu, I., Parlatan, U., Durkut, B., Ucak, M., **Unlu, M.B.**, et al. "Label-free differentiation of functional zones in mature mouse placenta using micro-Raman imaging." **Biomedical Optics Express 15**(5), 3441–3456 (2024).
12. Loc, I., **Unlu, M.B.** "Speeding up photoacoustic imaging using diffusion models." **arXiv preprint** arXiv:2312.08834 (2023).
13. Parlatan, U., Ozen, M.O., Kecoglu, I., Koyuncu, B., Torun, H., Khalafkhany, D., **Unlu, M.B.**, et al. "Label-free identification of exosomes using Raman spectroscopy and machine learning." **Small 19**(9), 2205519 (2023).
14. Sueyasu, S., Takayanagi, T., Miyazaki, K., Kuriyama, Y., Ishi, Y., Uesugi, T., **Unlu, M.B.**, et al. "Ionoacoustic application of an optical hydrophone to detect proton beam range in water." **Medical Physics 50**(4), 2438–2449 (2023).
15. Pesen, T., Haydaroglu, M., Capar, S., Parlatan, U., **Unlu, M.B.** "Comparison of the human's and camel's red blood cell deformability by optical tweezers and Raman spectroscopy." **Biochemistry and Biophysics Reports 35**, 101490 (2023).
16. Koyuncu, B., Melek, A., Yilmaz, D., Tuzer, M., **Unlu, M.B.** "Chemotherapy response prediction with diffuser elapser network." **Scientific Reports 12**(1), 1628 (2022).
17. Loc, I., Kecoglu, I., **Unlu, M.B.**, Parlatan, U. "Denoising Raman spectra using fully convolutional encoder-decoder network." **Journal of Raman Spectroscopy 53**(8), 1445–1452 (2022).
18. Kecoglu, I., Sirkeci, M., **Unlu, M.B.**, Sen, A., Parlatan, U., Guzelcimen, F. "Quantification of salt stress in wheat leaves by Raman spectroscopy and machine learning." **Scientific Reports 12**(1), 7197 (2022).
19. Parlatan, U., Parlatan, S., Sen, K., Kecoglu, I., Ulukan, M.O., Karakaya, A., **Unlu, M.B.**, et al. "Atrial fibrillation designation with micro-Raman spectroscopy and scanning acoustic microscope." **Scientific Reports 12**(1), 6461 (2022).
20. Debir, B., Meaney, C., Kohandel, M., **Unlu, M.B.** "The role of calcium oscillations in the phenotype selection in endothelial cells." **Scientific Reports 11**(1), 23781 (2021).
21. Nakamura, Y., Takayanagi, T., Uesaka, T., **Unlu, M.B.**, Kuriyama, Y., Ishi, Y., et al. "Range verification of pulsed proton beams from fixed-field alternating gradient accelerator by means of

time-of-flight measurement of ionoacoustic waves." **Medical Physics 48**(9), 5490–5500 (2021).

22. Algarawi, M., Erkol, H., Luk, A., Ha, S., Burcin Unlu, M., Gulsen, G., Nouizi, F. "Multi-Wavelength Photo-Magnetic Imaging System for Photothermal Therapy Guidance." **Lasers in Surgery and Medicine 53**(5), 713–721 (2021).
23. Takayanagi, T., Uesaka, T., Nakamura, Y., **Unlu, M.B.**, Kuriyama, Y., Uesugi, T., et al. "On-line range verification for proton beam therapy using spherical ionoacoustic waves with resonant frequency." **Scientific Reports 10**(1), 20385 (2020).
24. Algarawi, M., Erkol, H., Luk, A., Ha, S., Ünlü, M.B., Gulsen, G., Nouizi, F. "Resolving tissue chromophore concentration at MRI resolution using multi-wavelength photo-magnetic imaging." **Biomedical Optics Express 11**(8), 4244–4254 (2020).
25. Demirkan, I., Yaprak, G., Ceylan, C., Algul, E., Tomruk, C.O., Bilen, B., **Unlu, M.B.** "Acoustic diagnosis of elastic properties of human tooth by 320 MHz scanning acoustic microscopy after radiotherapy treatment for head and neck cancer." **Radiation Oncology 15**, 1–10 (2020).

TEACHING & ADVISING

Selected Courses — Boğaziçi University

Physics 101	Physics I: Mechanics
Physics 102	Physics II: Waves, Optics, and Thermodynamics
Physics 201	Physics III: Electricity & Magnetism
Physics 337	Introduction to Physical Methods in Medical Diagnosis
Physics 48M	Biophysics
Physics 58M	Physics of Medical Imaging

PhD Theses Supervised

2024	Arda İnanç	Label-free tissue imaging using micro-Raman spectroscopy
2024	İrem Loç	Denoising and enhancement in medical imaging modalities using deep learning
2024	Fulya Halıcılar	A comparison of acoustic waves generated in proton and carbon-ion therapy
2023	Defne Yılmaz	Modeling of drug delivery by modifying tumor microenvironment
2022	Çağrı Şenel	Numerical modeling, design, and time-frequency metrology of optical frequency combs
2022	Tuna Pesen İnanç	Probing mechanical and chemical properties of biological materials by multiple modalities
2022	Birses Debir	The role of trigger waves in cancer angiogenesis
2020	İrem Demirkan	Mechanical characterization of cells and tissues by SAM and optical tweezers
2018	Nasire Uluç	Photoacoustic signal characterization of cell morphology in microchannel flow
2018	Şirin Yonucu	Physical modeling of drug transport in cancer
2018	Aytaç Demirkıran	Photoacoustic signal detection via atomic force microscopy cantilevers
2017	Esra Aytaç Kipergil	A hybrid optical tweezers and photoacoustic microscopy system

MSc Theses Supervised (Selected)

2024	Ömer Fatih Dokumacı	Jet energy corrections with deep learning
2022	Tolga Gürcan	Total internal reflection holographic microscopy for cell extension imaging
2020	Gizem Alpakut	Glass welding using femtosecond fiber laser for microfluidic device development
2020	Melita Parlak	Tissue imaging with scanning acoustic microscopy and Raman spectroscopy
2017	Kadir Şimşek	Diffusion-attenuated MR signal for particles in disordered media
2016	Serhat Kaya	Active Brownian particles propelled by sound
2015	Mert Tuzer	Ultrasound simulations using computed tomography images as priors
2015	Defne Yılmaz	Acoustic radiation enhanced drug delivery
2013	Mustafa Ümit Arabul	Novel fiber laser-based backward-mode photoacoustic microscopy system
2013	Deniz Öztürk	Physical modeling of drug delivery in solid tumors
2012	Esra Aytaç Kipergil	Development of a Photoacoustic Microscopy System
2012	Şirin Yonucu	Mathematical modeling of MMPs in cancer

SCIENCE COMMUNICATION & OUTREACH

Creator and host of ***Formülsüz Hayat*** (*Life without Formula*), a 14-episode documentary series produced in collaboration with **TRT**, Turkey's largest public television network. The series makes complex concepts in physics and engineering accessible and engaging for Turkey's 25 million youth under 18, demonstrating the power of curiosity-driven learning and the translation of advanced research for broad public impact.