

Mustafa Mert BAYER, Ph.D.

Staff Optical Engineer

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Google Scholar: <https://scholar.google.com.tr/citations?user=p-DN1psAAAAJ&hl=en&oi=ao>

EDUCATION

- 2017 – 2022 **University of California, Irvine, CA** - Henry Samueli School of Engineering.
Ph.D. Major: Electrical Engineering and Computer Science
Ph.D. Thesis: Multi-Tone Continuous-Wave Lidar
- 2015 – 2017 **Koc University, Istanbul, Turkey** - Graduate School of Sciences and Engineering.
MSc. Major: Optoelectronics and Photonics Engineering
MSc. Thesis: Elastic Light Scattering and Optical Properties of a Diamond Microsphere
- 2010 – 2015 **Koc University, Istanbul, Turkey** - College of Science & College of Engineering.
Major: Physics
Double Major: Electrical and Electronics Engineering
Tracks: Optics and Electromagnetism Track

WORK EXPERIENCE

Luminar Technologies, FL – Staff Optical Engineer

Oct.2024 –Present

- Advanced optical receiver system development for the HALO lidar family, leading high-impact projects to enhance system performance.
- Designed and conducted sophisticated characterization experiments for lidar receiver subsystems using high-speed optics and electronics.
- Developed and implemented algorithms to evaluate receiver key performance indicators, ensuring seamless system integration.
- Contributed to receiver subsystem DFMEA and collaborated with electrical design teams to optimize APD and ROIC design.

Luminar Technologies, FL – Optical Engineer

Jan.2023 – Oct.2024

- Designed and implemented test stations to characterize optical receivers for the IRIS lidar family, used in Volvo and Mercedes vehicles.
- Improved manufacturing yield from 60% to over 97% by establishing robust pass/fail criteria and writing new test routines for the receiver calibration and characterization pipeline.
- Conducted MATLAB-based simulations and developed experiments to optimize SNR, detection thresholds, and false-alarm rates for IRIS lidar receivers.
- Partnered with the data science team to enhance calibration processes and deliver noise-free lidar point clouds.

UC Irvine, CA- Postdoctoral Scholar

Sep.2022 – Jan.2023

- Led a team to design and develop the prototype of [a CubeSat-based Optical Measurement System](#), a small satellite with lidar remote sensing, funded by the Office of Naval Research.
- Directed a team in developing a CubeSat-based lidar system prototype for space applications in collaboration with Aerospace Corporation, funded by the Office of Naval Research.
- Designed and executed in-lab remote sensing experiments for small satellites, driving advancements in space-based lidar technologies.

UC Irvine, CA - Research Assistant

Sep.2017 – Aug.2022

- Developed the Phase-Based Multi-Tone Continuous Wave (MTCW) Lidar concept.
 - Performed simulations via MATLAB, OptSim, VPI Photonics and Zemax to prove the novel lidar concept.
 - Developed and conducted proof-of-concept experiments to demonstrate the MTCW lidar concept for stationary and dynamic targets.

- Performed radiometric simulations to improve lidar collection in order to integrate the lidar to a CubeSat.
- Participated in the project “[The ARA Wireless Living Lab for Smart and Connected Rural Communities](#)”, supported by NSF.
 - Performed system-level engineering to integrate all subunits effectively.
 - Designed the telescope unit and optical backbone of the free-space optical communication link, alongside designing and integrating the beacon signal.
 - Developed the system requirements and evaluated the free-space optical antenna prototype.
- Participated in “[Omnidirectional Inter-Satellite Optical Communicator](#)” funded by NASA.
 - Engineered the optical communication link budget between satellites via simulations.
 - Designed the optical amplifier system to meet the link budget requirements.
- Worked on fiber based ultra-fast mode-locked lasers.
 - Performed MATLAB-based simulations to investigate the soliton explosion phenomenon in fiber based mode-locked lasers.
 - Developed algorithms to solve complex nonlinear differential equations by applying various numerical methods.

Koc University, Istanbul-Turkiye – [Research Assistant](#)

Sep.2015 – Aug.2017

- Worked as a research assistant in Koc University Microphotonics Research Lab (KUMRL)
 - Performed research on the nitrogen-vacancy centers in natural and synthetic diamonds.
 - Conducted experiments on optical microcavities, and spherical resonators of various materials including diamond, silicon, and ruby.

PATENTS

1. Mustafa Mert Bayer and Ozdal Boyraz. "Multi-tone continuous wave detection and ranging." U.S. Patent Application No.17/467,012.

PUBLICATIONS

1. A. Atalar, C. J. Margison, M. M. Bayer, X. Li, O. B. Boyraz, and O. Boyraz, "3D coherent single shot lidar imaging beyond coherence length," Opt. Express **32**, 40783–40793 (2024).
2. M. M. Bayer, A. Atalar, X. Li, H. Xie, and O. Boyraz, "Demonstration of Optical Clock-Free Localization and Navigation (CLAN)," in J. Lightwave Technol., **41**, 6457-6464 (2023).
3. M. M. Bayer, X. Li, G. N. Guentchev, R. Torun, J. E. Velazco, and O. Boyraz, "Single-shot ranging and velocimetry with a CW lidar far beyond the coherence length of the CW laser," Opt. Express **29**, 42343–42354 (2021).
4. M. M. Bayer and O. Boyraz, "Ranging and velocimetry measurements by phase-based MTCW lidar," Opt. Express **29**, 13552–13562 (2021).
5. M. M. Bayer, R. Torun, X. Li, J. E. Velazco, and O. Boyraz, "Simultaneous ranging and velocimetry with multi-tone continuous wave lidar," Opt. Express **28**, 17241–17252 (2020).
6. N. Yavuz, M. M. Bayer, H. O. Çirkinoğlu, A. Serpengüzel, T. Le Phu, A. Giakoumaki, V. Bharadwaj, R. Ramponi, and S. M. Eaton, "Laser-Inscribed Diamond Waveguide Resonantly Coupled to Diamond Microsphere," Molecules **25**, 2698 (2020).
7. R. Torun, M. M. Bayer, I. U. Zaman, J. E. Velazco, and O. Boyraz, "Realization of Multitone Continuous Wave Lidar," IEEE Photonics J. **11**, 1–10 (2019).
8. H. O. Çirkinoğlu, M. M. Bayer, A. Serpengüzel, S. Rampini, B. Sotillo, V. Bharadwaj, R. Ramponi, and S. M. Eaton, "Femtosecond laser written diamond waveguide excitation of the whispering gallery modes in a silicon microsphere," Opt. Mat. **92**, 418–424 (2019).
9. M. M. Bayer, H. O. Çirkinoğlu, and A. Serpengüzel, "Observation of Whispering-Gallery Modes in a Diamond Microsphere," IEEE Photon. Tech. L. **30**, 3–6 (2018).

10. H. O. Çirkinoğlu, M. M. Bayer, U. S. Gökay, A. Serpengüzel, B. Sotillo, V. Bharadwaj, R. Ramponi, and S. M. Eaton, "Silicon microsphere whispering gallery modes excited by femtosecond-laser-inscribed glass waveguides," *Appl. Opt.* **57**, 3687–3692 (2018).
11. M. H. Humayun, S. S. S. Bukhari, M. Zakwan, M. M. Bayer, U. S. Gökay, A. Serpengüzel, K. Taira, E. Omura, and J. Nakata, "Spatial intensity profiling of elastic and inelastic scattering in isotropic and anisotropic liquids by immersion of a spherical silicon photocell," *Appl. Opt.* **56**, 9384–9389 (2017).
12. O. M. Öztürk, M. M. Bayer, M. S. Anwar, M. Zakwan, and A. Serpengüzel, "Spectroscopy of a Nd: YVO₄ diode pumped solid state laser," *Microw. Opt. Techn. Lett.* **59**, 1636–1639 (2017).

CONFERENCE PUBLICATIONS

1. A. Atalar, C. J. Margison, M. M. Bayer, O. B. Boyraz, and O. Boyraz "3D coherent lidar imaging without coherence length limitation", *Proc. SPIE 13049, Laser Radar Technology and Applications XXIX*, 1304904 (2024).
2. M. M. Bayer, A. Atalar, X. Li, H. Xie, and O. Boyraz, "Photonic Localization and Positioning using Multi-Tone Continuous-Wave Ranging Methodology," *2023 IEEE Aerospace Conference*, Big Sky, MT, USA, 2023, pp. 1-7.
3. M. M. Bayer, B. U. Demirel, A. Atalar, X. Li, H. Xie, and O. Boyraz "Optical ranging and localization at beyond the coherence length of lasers", *Proc. SPIE 12438, AI and Optical Data Sciences IV*, 124380H (2023).
4. M. M. Bayer, Berken U. Demirel, A. Atalar, X. Li, H. Xie, and O. Boyraz "Machine-learning-enhanced phase-based multi-tone continuous-wave lidar", *Proc. SPIE 12428, Photonic Instrumentation Engineering X*, 124280I (2023).
5. M. M. Bayer, X. Li, A. Atalar, and O. Boyraz, "Phase-Based Multi-Tone CW Lidar: A Technique for Ranging Beyond the Coherence Length of the CW Laser," in *Conference on Lasers and Electro-Optics (CLEO)* (2022), p. ATu4M.1.
6. M. M. Bayer, A. Atalar, X. Li, and O. Boyraz, "Photonics PNT Based on Multi-Tone Continuous Wave Ranging," in *Conference on Lasers and Electro-Optics, (CLEO)* (2022), p. JTh3A.57.
7. X. Li, M. M. Bayer, G. N. Guentchev, and O. Boyraz, "Design and Prototype of Auto-Track Long-Range Free-Space Optical Communication," in *2022 Optical Fiber Communications Conference and Exhibition (OFC)* (2022), pp. 1–3.
8. M. M. Bayer, G. N. Guentchev, X. Li, J. E. Velazco, and O. Boyraz "Enhancing the multi-tone continuous-wave lidar with phase detection", *Proc. SPIE* **11828**, 1182807 (2021).
9. G. N. Guentchev, M. M. Bayer, X. Li, and O. Boyraz "Mechanical design and thermal analysis of a 12U CubeSat MTCW lidar-based optical measurement system for littoral ocean dynamics", *Proc. SPIE* **11832**, 118320B (2021).
10. M. M. Bayer, R. Torun, I. U. Zaman, and O. Boyraz, "Multi-Tone Continuous Wave Lidar in Simultaneous Ranging and Velocimetry," in *Conference on Lasers and Electro-Optics (CLEO)* (2020), p. SM1O.6.
11. M. M. Bayer, R. Torun, I. U. Zaman, and O. Boyraz, "A Basic Approach for Speed Profiling of Alternating Targets with Photonic Doppler Velocimetry," in *Conference on Lasers and Electro-Optics (CLEO)* (2019), p. AW4K.4.
12. I. U. Zaman, A. S. Behbahani, M. M. Bayer, S. Shaboyan, A. Eltawil, and O. Boyraz, "A Comparative Study of Inter CubeSat High-Speed Links: RF, mmWave, and Optical," in *IEEE International Conference on Space Optical Systems and Applications (ICSOS)* (2019).
13. P. Sadri-Moshkenani, M. W. Khan, M. M. Bayer, M. S. Islam, E. Montoya, I. Krivortov, M. Nilsson, N. Bagherzadeh, and O. Boyraz, "Effect of Tantalum and MgO adhesion layers on plasmonic nanostructures," *Proc. SPIE* **11089**, 1108916 (2019).
14. R. Torun, M. M. Bayer, I. U. Zaman, and O. Boyraz, "Multi-tone modulated continuous-wave lidar," *Proc. SPIE* **10925**, 109250V (2019).

15. O. Boyraz, M. M. Bayer, R. Torun, and I. Zaman, "Multi Tone Continuous Wave Lidar," in *IEEE Photonics Society Summer Topical Meeting Series (SUM)* (2019), pp. 1–2.
16. S. Sultan Shah Bukhari, M. R. Chaudhry, M. M. Bayer, and A. Serpengüzel, "Elastic Scattering from a Sapphire Microsphere in the THz Region," in *Frontiers in Optics 2016, (FiO)*(2016), p. JTh2A.180.
17. M. Zakwan, M. M. Bayer, M. S. Anwar, U. S. Gökay, and A. Serpengüzel, "Mid-infrared elastic scattering from germanium microspheres," in *International Conference on Transparent Optical Networks 2016, (ICTON)* (2016), pp. 1–1.

PROJECTS

- Jan.2023 – Present **Luminar Technologies IRIS and IRIS+ Lidar Platforms for Volvo and Mercedes Benz ADAS Programs**
Role: Evaluating and testing the optical receiver specifications. Receiver performance characterization of the lidar systems for Volvo EX90 start-of-production and Mercedes Benz ADAS programs. Overseeing the receiver calibration process and developing pass/fail criteria for the high-volume production line.
- Apr.2021- Aug.2022 **ARA Wireless Living Lab for Smart and Connected Rural Communities funded by NSF PAWR-5582469.**
Role: System-level engineering by leading the team members to realize the integration of all subunits. Design of the telescope unit and optical backbone of the free-space optical communication link and design and integration of the beacon signal. Characterization of the system requirements and optical parameters. Integration of the motor subsystem with the optical telescope.
- Jun.2018 – Aug.2022 **CubeSat-based Optical Measurement System for Littoral Ocean Dynamics funded by Office of Naval Research with Award # N00014-18-1-2845**
Role: System-level engineering by leading the team members to realize the integration of all subunits. Design of optical transmission and reception units for the Lidar system. Integration of the Lidar to the spacecraft. Optimization of design parameters, scanning modes, and mission metrics.
- Sep.2017 – Mar.2019 **Omnidirectional Inter-Satellite Optical Communicator funded by NASA Cooperative Agreement, Grant No: NNX16AT64A**
Role: Estimate the optical link budgets between the satellites. Design and evaluate an optical amplifier system to satisfy link requirements. Characterization of optical beam divergence due to collimator properties.

TEACHING EXPERIENCE

- Sep.2018 – Aug.2020 **UC Irvine, CA, Teaching Assistant**
 EECS 170A – Electronics I Laboratory session TA,
 EECS 70A – Circuits Laboratory session and Discussion session TA,
 ECPS 204 – Embedded System Software Discussion TA
- May.2013 – Aug.2017 **Koc University, Istanbul - Turkey, Teaching Assistant**
 PHYS 206 - Modern Physics Laboratory session TA
 PHYS 405/505 - Experimental Physics Laboratory session TA.

PROFESSIONAL SERVICES

- Jan.2019 – Present Manuscript reviewing for journals such as Applied Optics, Optics Express, Optics Letters, OSA Continuum, and IEEE Transactions on Communications.

AWARDS

- Sept.2015 – Nov.2016 TUBITAK Research Scholarship
 2014, 2013, and 2010 Koc University Dean's Honor Roll
 Fall 2012 Koc University 2012 Spring Vehbi Koc Honors Reward

MEMBERSHIPS

Feb. 2016 – Present Optica, SPIE, and IEEE membership & reviewer

Feb. 2016 – Aug.2017 Optical Society of America Koc University Student Chapter Vice President

ADDITIONAL INFORMATION

Languages: **English, Turkish (Native), and German (A2 Level)**

Software knowledge: MATLAB, Python, Lab View, Rsoft-Optsim, Zemax, VPI Optical Design
Software, Raspberry Pi+3 Programming, MS Office