

Serkan Butun, PhD.

Research Associate

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Work Experience

- **Research associate** – Micro/Nano Fabrication Facility, Northwestern University *2019-present*
- **Postdoctoral researcher** – Micro/Nano Fabrication Facility, Northwestern University *2016-2019*
- **Postdoctoral researcher** – Dept. Electrical Engineering and Computer Science, Northwestern University *2012-2016*
- **Research Assistantship** – Dept. of Physics, Bilkent University
 - Research Assistant – Nanotechnology Research Center, Bilkent University *2006-2011*
- **Teaching Assistantship** – Dept. of Physics, Bilkent University *2005-2011*
 - Supervisor – Undergraduate level Quantum Mechanics Laboratory
 - Instructor – LabVIEW for experimental physics *Spring 2008*

Research Experience

- Design, fabrication and testing of metamaterial/plasmonic absorbers and functional thin films for solar cells and sensing applications
- Design and fabrication of UV plasmonic antenna coupled sub-wavelength photodetector
- Fabrication and characterization of GaN based MSM photodiodes
- Process development of field effect devices on epitaxial and exfoliated *graphene* flakes. Fabricated graphene RF transistors, field effect Hall bars for Magneto-transport measurements, Performed DC and AC device characterization, temperature dependent Hall Effect measurements in the course of EU funded EPIGRAT project.
- Constructed a unique fully automated Spatially and Angle-Resolved Spectral Photocurrent Mapping System. (Partial support awarded by Initiative for Sustainable energy at Northwestern)
- Multi-level photomask CAD design for semiconductor device fabrication
- Constructed a fully automated photoconductivity measurement setup for UV.
- Constructed a fully automated persistent photoconductivity measurement setup.
- Constructed a custom micro transmission/reflection measurement setup for single particle spectroscopy.
- Fabricated nanostructures for biological sensing and SERS applications.
- Designed and manufactured custom experimental setup parts.

Education

- **Ph.D.** Physics, Bilkent University, Turkey *2011*
 - “AlGa_N UV Photodetectors: From Micro to Nano”
- **M.S.** Physics, Bilkent University, Turkey *2006*
 - “The growth, fabrication and characterization of high performance Al_xGa_{1-x}N metal-semiconductor-metal photodiodes”
- **B. S.** Physics, Bilkent University, Turkey *2004*

Cleanroom Experience

- E-Beam lithography for plasmonic and metamaterial devices and gate fabrication on Graphene based transistors
- Focused Ion Beam (FIB) milling for device analysis and photonic structure fabrication
- Maskless lithography
- Photolithography mask design and fabrication
- Optical contact lithography (Hg i- and h-lines)
- Picosecond Laser Cutting
- RIE (Si, Ge, GaN, AlGa_N, SiO₂, Si₃N₄)
- ICP-RIE (SiO₂, Si₃N₄, GaAs, GaN, AlGa_N, InGa_N)
- DRIE (Si)
- Wet etching techniques (Buffered oxide etch, Au, Cu and Cr etchants)
- Wet semiconductor cleaning (TCA-ACE-IPA, Piranha)
- PECVD growth of dielectric thin films (Si₃N₄, SiO₂)
- RF Magnetron Sputtering of thin films (SiO₂, Si₃N₄, ITO)
- Lab Manager
 - Optical Lithography, Contact and Maskless lithography process development, user training, maintenance
 - Metal, Dielectric Deposition, process support and maintenance (PECVD, DRIE, E-Beam Dep, DC/RF magnetron Sputtering)
 - Class 100 Cleanroom upkeep and inventory tracking
- Thermal and e-beam metal deposition (Al, Ag, Au, Cr, Ti and Pt)
- MOCVD growth of Nitride based semiconductors

Device Testing Experience

- Photoluminescence (Cryogenic and room temperature)
- Spectral ellipsometry
- AFM – STM surface characterization
- FTIR
- Low level (fA) IV characterization (Cryogenic and room temperature)
- Lock-in amplifier based photoconductivity measurements
- Noise measurement and analysis of UV photodiodes

Computational Skills

- Finite difference time domain simulations using *Lumerical FDTD*
- Data analysis, optimization, web based process tracking with *Python*
- Measurement and automation with *LabVIEW*
- Coding in *Matlab* for DBR and AR coating optimization and data analysis
- CAD (AutoCAD, Ledit, Klayout, Solidworks)

Honors and Awards

- Best poster presentation award at 13th National Optics, Electro-optics and Photonics Conference

- Travel grant from IEEE Photonics Society 2009
- Full Scholarship awarded by Bilkent University for graduate study 2004 – 2011
- Full Scholarship awarded by Bilkent University for undergraduate study 1998 – 2004

Publications

- **Summary**

Peer-reviewed journal publications – 45

Conference proceedings – 6

Conference oral and poster presentations – 13; 1 invited; 10 oral; 3 poster

Publication List

- 45) BD Myers, E Palacios, D Myers, **S Butun**, K Aydin, VP Dravid, Stimuli-Responsive DNA-linked Nanoparticle Arrays as Programmable Surfaces, *Nano letters* 19 (7), 4535-4542 (2019)
- 44) H Kocer, A Ozer, **S Butun**, K Wang, J Wu, H Kurt, K Aydin, Thermally Tuning Infrared Light Scattering Using Planar Layered Thin Films and Space Gradient Metasurface, *IEEE Journal of Selected Topics in Quantum Electronics* 25 (3), 1-7 (2019)
- 43) Z Liu, B Banar, **S Butun**, H Kocer, K Wang, J Scheuer, J Wu, K Aydin, Dynamic infrared thin-film absorbers with tunable absorption level based on VO₂ phase transition, *Optical Materials Express* 8 (8), 2151-2158 (2018)
- 42) Z Liu, SA Wells, **S Butun**, E Palacios, MC Hersam, K Aydin, Extrinsic polarization-controlled optical anisotropy in plasmon-black phosphorus coupled system, *Nanotechnology* 29 (28), 285202 (2018)
- 41) QY Lin, JA Mason, Z Li, W Zhou, MN O'Brien, KA Brown, MR Jones, **S Butun**, B Lee, VP Dravid, K Aydin, CA Mirkin, Building superlattices from individual nanoparticles via template-confined DNA-mediated assembly, *Science* 359 (6376), 669-672 (2018)
- 40) E Palacios, S Park, **S Butun**, L Lauhon, K Aydin, Enhanced radiative emission from monolayer MoS₂ films using a single plasmonic dimer nanoantenna, *Applied Physics Letters* 111 (3), 031101 (2017)
- 39) **S Butun**, E Palacios, JD Cain, Z Liu, VP Dravid, K Aydin, Quantifying Plasmon-Enhanced Light Absorption in Monolayer WS₂ Films, *ACS applied materials & interfaces* 9 (17), 15044-15051 (2017)
- 38) B Tang, Z Li, E Palacios, Z Liu, **S Butun**, K Aydin, Chiral-selective plasmonic metasurface absorbers operating at visible frequencies, *IEEE Photonics Technology Letters* 29 (3), 295-298 (2017)
- 37) **S Butun**, K Aydin, Functional metal-insulator-metal top contacts for Si-based color photodetectors, *Journal of Applied Physics* 120 (22), 223102 (2016)
- 36) RA Pala, **S Butun**, K Aydin, HA Atwater, Omnidirectional and broadband absorption enhancement from trapezoidal Mie resonators in semiconductor metasurfaces, *Scientific reports* 6, 31451 (2016)
- 35) F Callewaert, S Chen, **S Butun**, K Aydin, Narrow band absorber based on a dielectric nanodisk array on silver film, *Journal of Optics* 18 (7), 075006 (2016)
- 34) Z Li, **S Butun**, K Aydin, Lithography-free transmission filters at ultraviolet frequencies using ultra-thin aluminum films, *Journal of Optics* 18 (6), 065006 (2016)

- 33) Z Li, E Palacios, **S Butun**, K Aydin, Ultrawide Angle, Directional Spectrum Splitting with Visible-Frequency Versatile Metasurfaces, *Advanced Optical Materials* DOI: 10.1002/adom. 201600068 (2016)
- 32) **S Butun**, K Aydin, Asymmetric Light Absorption and Reflection in Freestanding Nanostructured Metallic Membranes, *ACS Photonics* 2 (12), 1652-1657 (2015)
- 31) H Kocer, **S Butun**, E Palacios, Z Liu, S Tongay, D Fu, K Wang, J Wu, K Aydin, Intensity tunable infrared broadband absorbers based on VO₂ phase transition using planar layered thin films, *Scientific reports*, 5, 13384 (2015)
- 30) NA Cinel, S Cakmakyapan, **S Butun**, G Ertas, E Ozbay, E-Beam lithography designed substrates for surface enhanced Raman spectroscopy, *Photonics and Nanostructures-Fundamentals and Applications* 15, 109-115 (2015)
- 29) QY Lin, Z Li, KA Brown, MN O'Brien, MB Ross, Y Zhou, **S Butun**, PC Chen, George C Schatz, Vinayak P Dravid, Koray Aydin, Chad A Mirkin, Strong Coupling between Plasmonic Gap Modes and Photonic Lattice Modes in DNA-Assembled Gold Nanocube Arrays *Nano Letters* 15 (7), 4699–4703 (2015)
- 28) H Kocer, **S Butun**, B Banar, K Wang, S Tongay, J Wu, K Aydin, Thermal tuning of infrared resonant absorbers based on hybrid gold-VO₂ nanostructures, *Applied Physics Letters* 106 (16), 161104 (2015)
- 27) **S Butun**, S Tongay, K Aydin, Enhanced Light Emission from Large-Area Monolayer MoS₂ using Plasmonic Nanodisc Arrays, *Nano Letters* 15 (4), 2700–2704 (2015)
- 26) H Kocer*, **S Butun***, Z Li, K Aydin, Reduced near-infrared absorption using ultra-thin lossy metals in Fabry-Perot cavities, *Scientific reports* 5, 8157 (2015) (* equal contribution)
- 25) Z Li, E Palacios, **S Butun**, K Aydin, Visible-frequency metasurfaces for broadband anomalous reflection and high-efficiency spectrum splitting, *Nano Letters* 15 (3), 1615–1621 (2015)
- 24) Z. Li, **S. Butun**, and K. Aydin, Large-area, lithography-free super absorbers and color filters at visible frequencies using ultrathin metallic films, *ACS Photonics*, 2, 183 (2015)
- 23) NA Cinel, S Cakmakyapan, **S Butun**, G Ertas, O Ekmel, E-Beam lithography designed substrates for surface enhanced raman spectroscopy, *Photonics and Nanostructures-Fundamentals and Applications* Available online (2015)
- 22) **S Butun**, K Aydin, Structurally tunable resonant absorption bands in ultrathin broadband plasmonic absorbers, *Optics express* 22 (16), 19457-19468 (2014)
- 21) Z Li, **S Butun**, K Aydin, Ultranarrow Band Absorbers Based on Surface Lattice Resonances in Nanostructured Metal Surfaces, *ACS nano* 8 (8), 8242-8248 (2014)
- 20) E Arslan, S Çakmakyapan, Ö Kazar, **S Butun**, SB Lişesivdin, NA Cinel, *et al.* SiC Substrate effects on electron transport in the epitaxial graphene layer *Electronic Materials Letters* 10 (2), 387-391(2014)
- 19) Z Li, **S Butun**, K Aydin, Touching gold nanoparticle chain based plasmonic antenna arrays and optical metamaterials, *ACS Photonics* 1 (3), 228-234 (2014)
- 18) SB Lisesivdin, G Atmaca, E Arslan, S Çakmakyapan, Ö Kazar, **S Butun**, *et al.* Extraction and scattering analyses of 2D and bulk carriers in epitaxial graphene-on-SiC structure *Physica E: Low-dimensional Systems and Nanostructures* 63, 87-92 (2014)
- 17) **S Butun**, N Cinel and E Ozbay, Lspr enhanced MSM UV photodetectors, *Nanotechnology*, 23 (44), 444010 (2012)
- 16) N Cinel, **S Butun**, G Ertas and E Ozbay. Fairy chimney shaped tandem metamaterials as double resonance SERS substrates. *Small* 9 (4), 489-489 (2012)
- 15) M Gökkavas*, **S Butun***, P Caban, W Strupinski, E Ozbay. Integrated AlGaN quadruple-band ultraviolet photodetectors, *Semiconductor Science and Technology* 27 (6), 065004 (2012) (* equal contribution)
- 14) **Butun, S.**, Cinel, N. & Ozbay, E. Nanoantenna coupled GaN photodetectors enhanced by UV surface plasmons. *Optics Express* 20 (3), 2649-2656 (2012)

- 13) Cinel, N., **Butun, S.** & Ozbay, E. Electron Beam Lithography designed silver nano-cylinders used as label free nano-biosensors based on Localized Surface Plasmon Resonance. *Optics Express* **20** (3), 2587-2597 (2012)
- 12) Arslan, E.*, **Butun, S.***, Safak, Y., Uslu, H., Tascioglu, I., Altindal, S. & Ozbay, E. Electrical characterization of MS and MIS structures on AlGaN/AlN/GaN heterostructures. *Microelectron Reliab* **51**, 370-375, (2011) (* equal contribution)
- 11) Arslan, E., **Butun, S.**, Safak, Y., Cakmak, H., Yu, H. B. & Ozbay, E. Current transport mechanisms and trap state investigations in (Ni/Au)-AlN/GaN Schottky barrier diodes. *Microelectron Reliab* **51**, 576-580, (2011)
- 10) Arslan, E., **Butun, S.**, Safak, Y. & Ozbay, E. Investigation of Trap States in AlInN/AlN/GaN Heterostructures by Frequency-Dependent Admittance Analysis. *J Electron Mater* **39**, 2681-2686, (2010)
- 9) Arslan, E.*, **Butun, S.*** & Ozbay, E. Leakage current by Frenkel-Poole emission in Ni/Au Schottky contacts on Al(0.83)In(0.17)N/AlN/GaN heterostructures. *Appl Phys Lett* **94**, (2009) (* equal contribution)
- 8) Arslan, E.*, **Butun, S.***, Lisesivdin, S. B., Kasap, M., Ozcelik, S. & Ozbay, E. The persistent photoconductivity effect in AlGaN/GaN heterostructures grown on sapphire and SiC substrates. *J Appl Phys* **103**, (2008) (* equal contribution)
- 7) Gokkavas, M., **Butun, S.**, Tut, T., Biyikli, N. & Ozbay, E. AlGaN-based high-performance metal-semiconductor-metal photodetectors. *Photonic Nanostruct* **5**, 53-62, (2007)
- 6) Yu, H. B., Strupinski, W., **Butun, S.** & Ozbay, E. Mg-doped AlGaN grown on an AlN/sapphire template by metalorganic chemical vapour deposition. *Phys Status Solidi A* **203**, 868-873, (2006)
- 5) Tut, T., Gokkavas, M., Butun, B., **Butun, S.**, Ulker, E. & Ozbay, E. Experimental evaluation of impact ionization coefficients in Al_xGa_{1-x}N based avalanche photodiodes. *Appl Phys Lett* **89**, (2006)
- 4) Gokkavas, M.*, **Butun, S.***, Yu, H. B., Tut, T., Butun, B. & Ozbay, E. Dual-color ultraviolet metal-semiconductor-metal AlGaN photodetectors. *Appl Phys Lett* **89**, (2006), (* equal contribution)
- 3) **Butun, S.**, Tut, T., Butun, B., Gokkavas, M., Yu, H. B. & Ozbay, E. Deep-ultraviolet Al_{0.75}Ga_{0.25}N photodiodes with low cutoff wavelength. *Appl Phys Lett* **88**, (2006)
- 2) **Butun, S.**, Gokkavas, M., Yu, H. B. & Ozbay, E. Low dark current metal-semiconductor-metal photodiodes based on semi-insulating GaN. *Appl Phys Lett* **89**, (2006)
- 1) Tut, T., **Butun, S.**, Butun, B., Gokkavas, M., Yu, H. B. & Ozbay, E. Solar-blind Al_xGa_{1-x}N-based avalanche photodiodes. *Appl Phys Lett* **87**, (2005)

Conference Proceedings

- 6) NA Cinel, **S Butun**, E Özbay, Plasmonic nanoparticle based nanobiosensors and nanophotodetectors, *SPIE OPTO*, 86321P-86321P-7 (2013)
- 5) AT Roberts, **S Butun**, K Aydin, HO Everitt, M Bloemer, G D'Aguanno, Nadia Mattiucci, Ultraviolet surface-enhanced Raman spectroscopy using aluminum plasmonic gratings, *APS Meeting Abstracts* 1, 22004 (2013)
- 4) G D'Aguanno, N Mattiucci, **S Butun**, J Callahan, HO Everitt, *et al.* UV-SERS Assisted by Nano-Focusing in Plasmonic Gratings with Tapered Slits *Frontiers in Optics*, FTu3A. 68 (2012)
- 3) NA Cinel, **S Bütün**, E Özbay, SILVER nano-cylinders designed by EBL used as label free LSPR nano-biosensors, *SPIE BiOS*, 79111I-79111I-7 (2011)
- 2) M Gokkavas, **S Butun**, P Caban, W Strupinski, E Ozbay, AlGaN quadruple-band photodetectors *LEOS'09. IEEE*, 365-366 (2009)
- 1) Ozbay, E., Aydin, K., **Butun, S.**, Kolodziejak, K. & Pawlak, D. Ferroelectric based tuneable SRR based metamaterial for microwave applications. *2007 European Microwave Conference, Vols 1-4*, 497-499, (2007)

Professional Presentations

- 13) MRS Spring Meeting 2014 (San Francisco, CA) *April 2014*
- 12) MRS Spring Meeting 2013 (San Francisco, CA) *April 2013*
- 11) Center for Quantum Devices (Evanston, IL) *March 2012*
- 10) 13th National Optics, Electro-optics and Photonics Conference (Ankara, Turkey) *September 2011*
- 9) [Nanophotonics for Energy Efficiency Plenary Meeting \(Stockholm, Sweden\)](#) *June 2011*
- 8) MRS Spring Meeting 2011 (San Francisco, CA) *April 2011*
- 7) (invited) IEEE Photonics Society Annual Meeting 2010 (Denver, CO) *November 2010*
- 6) MRS Fall Meeting 2009 (Boston, MA) *December 2009*
- 5) IEEE Photonics Society Annual Meeting 2009 (Antalya, Turkey) *October 2009*
- 4) SSOP Summer School on Plasmonics (Côte d'Azur, France) *September 2009*
- 3) Mediterranean Conference on Nano Photonics (Istanbul, Turkey) *October 2008*
- 2) PhOREMOST Scientific Workshop (Florence, Italy) *June 2006*
- 1) International School of Quantum Electronics, Photonic metamaterials:
From micro to nano scale (Erice, Italy) *August 2005*