

## Omer Gokalp MEMIS, Ph.D.

*Citizenship:* Turkish  
US Legal Permanent Resident (LPR)  
*Email:* [gokalp@northwestern.edu](mailto:gokalp@northwestern.edu)  
*Phone:* 847-201-4151  
*Work Address:* 2145 Sheridan Rd, EECS Dept, Evanston, IL 60208

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### EDUCATION

09/2005-03/2010:	Ph.D., Electrical Eng. and Computer Sci., Northwestern Uni., Evanston, IL	4.00 / 4.00
09/2003-07/2005:	M.Sc., Electrical and Electronics Engineering, Bilkent Uni., Ankara, Turkey	4.00 / 4.00
09/1999-07/2003:	B.Sc., Electrical and Electronics Engineering, Bilkent Uni., Ankara, Turkey	3.87 / 4.00

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### AWARDS & HONORS

10/2011: Awarded "International Institute of Nanotechnology Outstanding Research"  
06/2010: Awarded "Best PhD Dissertation" by the Electrical Engineering and Computer Science Department at the Northwestern University.  
07/2009: Awarded McCormick School of Engineering Terminal Year Fellowship by Northwestern University.  
12/2007: Awarded Ryan Fellowship by Northwestern University to pursue research in Nanotechnology.  
03/2005: Awarded Walter P. Murphy Fellowship by Northwestern University, Full Scholarships by Stanford and Johns Hopkins Universities.  
12/2004: Ranked 1<sup>st</sup> among graduate students in the Bilkent University Electrical and Electronics Eng.  
09/2003 - 07/2005: Full Graduate Scholarship by Bilkent University.  
06/2003: Ranked 6<sup>th</sup> among the B.Sc. graduates of Bilkent University Electrical and Electronics Eng.  
01/ 2003: Ranked 12<sup>th</sup> / 50,000 in nation-wide Graduate Education Examination (Equivalent of GRE)  
07/1999 - 07/2003: Full Undergraduate Scholarship by Bilkent University  
06/1999: Ranked 42<sup>nd</sup> / 1,500,000 in the National University Election and Placement Examination

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### TECHNICAL SKILLS

*Fabrication:* Photo and e-beam lithography, FIB, RIE, ICP, PECVD, ALD, SEM, flip-chip bonding, indium-bump bonding, electro- and electroless-plating, polishing, ellipsometry  
*Measurement:* AFM, FTIR, MRI, OCT, low temperature cryostats, high-speed oscilloscopes (real-time and sampling), spectrum analyzers, low-noise and high-bandwidth amplifiers (LNA), optical time-domain reflectometers (OTDR), electrical time-domain reflectometers (TDR/TDT), vector network analyzers (VNA), lock-in amplifiers, pulse generators, LCR meters.  
*Software:* MATLAB, Labview, COMSOL Multiphysics, Lumerical, Silvaco, Pspice, L-Edit, EAGLE, PSPICE, Magic, Xilinx, Assembly, Basic, JAVA, C/C++, \*nix-based systems, MS Office.

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### COMMUNICATION SKILLS

*Language:* English (Fluent), Turkish (Native), German (Poor)

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### MEMBERSHIPS

*IEEE* (10/99-Present), *IEEE Photonic Society* (03/06-Present), *OSA* (09/04-Present), *SPIE* (09/04-Present)

## RESEARCH EXPERIENCE

03/2010 – Present: **Northwestern University**, Post-Doctoral Fellow  
09/2005 – 03/2010: **Northwestern University**, Research Assistant

### **Novel Bio-inspired Nano-Injection Single Photon Detectors and Imagers.**

- Led the design, fabrication and testing of the novel detector from an individual detector to imagers.
- Developed a nonlinear 3-D FEM based simulation model to design and optimize a novel detector.
- Achieved highest reported stable gain values in detectors (10,000+), with ultra low noise levels.
- Demonstrated very fast operation with the lowest reported jitter (<14ps at room temperature).
- Manufactured novel short wave infrared imagers with extremely high sensitivity (28e- noise at 2000 frames/s).
- The imager demonstrated two orders or magnitude higher signal-to-noise compared to state-of-the-art IR cameras.
- Built unique optical and electrical test setups to measure a wide range of parameters and map the sample in visual and infrared spectra simultaneously, automated using Labview and Matlab.

### **Secondary Research Projects: Plasmonic Nanoantennas on Quantum Cascade Lasers, All-Optical Switchable Lasers, Optoelectromechanical Photon Detectors, Novel Quantum Cascade Lasers, Tunable Quantum Well Infrared Detectors, Fiber-Optic Biosensors and Fiber-Optic Based Tunable Filters.**

- Worked as part of different teams on various projects.
- Developed 3-D FEM and FDTD based simulation models for electronic, photonic, thermal, structural and quantum mechanical phenomena and devices.
- Designed and fabricated different devices including optoelectromechanical detectors, QCLs, QWIPs, electrooptic modulators and plasmonic nanoantennas.
- Developed a near-field scanning microscope, a modified-FTIR based characterization setup and multiple low-noise/high-speed test setups for measurements on short-, mid- and long-wave infrared devices and plasmonics.

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06/2007 – 07/2007: **Fermilab**, Intern

### **Silicon Based Vertex Detector Simulation Using Silvaco.**

- Improved the quantum efficiency and pixel isolation by optimizing the vertex detector structure parameters.
- Helped explain the device physics, gain insight into the device, and quantified the design differences.
- Developed 2-D and 3-D models for a silicon based vertex detector for the Tevatron particle accelerator.

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09/2004 – 07/2005: **Bilkent University**, Research Assistant

### **Design and Construction of “Ultra-low Noise Optical Transmission System for MRI Signals”.**

- Designed and built ultra-low noise amplifiers and an electro-optic transmitter for interventional and parallel imaging. Custom built or modified components to fit MRI specifications.
- Demonstrated ultra-low noise operation (noise figure <1dB) with very small overall power consumption.
- Acquired images with a real MRI scanner to test performance in situ.

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06/2001-07/2001: **Mobilsoft Inc**, Intern

**Summer internship on “Web-Based Distance Learning Software”:** Worked on and increased the speed of the audiovisual multicasting module more than twice by optimization of the algorithm, better selection of compression methods and removing redundancy.

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06/2000-07/2000: **ASELSAN Inc**, Intern

**Summer internship at ASELSAN Inc:** Built a sample-and-hold amplifier using surface mount components.

## BOOK CHAPTERS

- 1) H. Mohseni and **O.G. Memis**, “Nano-Injection Photon Detectors for Sensitive, Efficient Infrared Photon Detection and Counting”, a chapter of VLSI Micro- and Nanophotonics: Science, Technology, and Applications, edited by E.-H. Lee, L. Eldada, M. Razeghi, C. Jagadish, CRC Press 2010.
  - 2) **O.G. Memis** and H. Mohseni, “Nano-Injection Detectors and Imagers for Sensitive and Efficient Infrared Detection”, a chapter of Information Optics and Photonics: Algorithms, Systems, and Applications, edited by T. Fournel (Editor), B. Javidi, Springer (2010).
  - 3) **O.G. Memis** and H. Mohseni, “Design of the Nano-injection Detectors using Finite-Element-Modeling”, a chapter of Computational Finite Element Methods in Nanotechnology, edited by S. M. Musa, CRC Press (in press)
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## JOURNAL PAPERS

- 1) J. Kohoutek, D. Dey, A. Bonakdar, R. Gelfand, V. Fathipour, **O. G. Memis**, H. Mohseni, “Mechanical frequency and amplitude modulation of quantum cascade laser integrated with plasmonic nanoantenna”, *Small* 8, 3781 (2012).
- 2) J. Kohoutek, A. Bonakdar, R. Gelfand, D. Dey, I. Hassani, V. Fathipour, **O. G. Memis**, and H. Mohseni, “Integrated all-optical Infrared Switchable Plasmonic Quantum Cascade Laser”, *Nano Letters* 12, 2537 (2012).
- 3) J. Kohoutek, D. Dey, A. Bonakdar, R. Gelfand, A. Sklar, **O.G. Memis**, H. Mohseni, “Opto-Mechanical Force Mapping of Deep Subwavelength Plasmonic Modes”, *Nano Letters* 11(8), 3378-3382 (2011).
- 4) **O. G. Memis**, J. Kohoutek, W. Wu, R. M. Gelfand, H. Mohseni, “A Short-Wave Infrared Nano-Injection Imager with 2,500 A/W Responsivity and Low Excess Noise”, *IEEE Photonics Journal* 2(5), 858 (2010).
- 5) **O. G. Memis**, J. Kohoutek, W. Wu, R. M. Gelfand, H. Mohseni, “Signal-to-noise performance of a short-wave infrared nano-injection imager”, *Optics Letters* 35 (16), 2699 (2010)
- 6) J. Kohoutek, I. Y. L. Wan, **O. G. Memis**, and H. Mohseni “An opto-electro-mechanical infrared photon detector with high internal gain at room temperature” *Optics Express* 17 (17), 14458, (2009).
- 7) W. Wu, D. Dey, **O. G. Memis**, and H. Mohseni, “Modeling and fabrication of electrically tunable quantum dot intersubband devices”, *Applied Physics Letters*, 94, 193113, (2009).
- 8) D. Dey, W. Wu, **O. G. Memis**, H. Mohseni, “Injectorless quantum cascade laser with low voltage defect and improved thermal performance grown by metal-organic chemical-vapor deposition”, *Appl. Phys. Lett.* 94, 081109 (2009).
- 9) W. Wu, D. Dey, **O. G. Memis**, A. Katsnelson, and H. Mohseni, “Fabrication of Large Area Periodic Nanostructures Using Nanosphere Photolithography”, *Nanoscale Research Letters*, 3, 351 (2008)
- 10) **O.G. Memis**, A. Katsnelson, H. Mohseni, M. Yan, S. Zhang, T. Hossain, N. Jin, I. Adesida, “On the Source of Jitter in a Room-Temperature Nano-injection Photon Detector at 1.55  $\mu\text{m}$ ”, *IEEE Electron Device Lett*, 29(8), 867 (2008)
- 11) W. Wu, D. Dey, A. Katsnelson, **O. G. Memis**, and H. Mohseni, “Large areas of periodic nano-holes perforated in multi-stacked films produced by lift-off”, *Journal of Vacuum Science and Technology B*, 26 (5), 1745 (2008)
- 12) **O.G. Memis**, A. Katsnelson, S. C. Kong, H. Mohseni, M. Yan, S. Zhang, T. Hossain, N. Jin, and I. Adesida, “Sub-Poissonian Shot Noise of a High Internal Gain Injection Photon Detector”, *Optics Express*, 16(17), 12701, (2008).
- 13) **O. G. Memis**, Y. Eryaman, O. Aytur, and E. Atalar, “Miniaturized Fiber-Optic Transmission System for MRI Signals,” *Magnetic Resonance in Medicine*. 59, 165 (2008)
- 14) W. Wu, D. Dey, **O. G. Memis**, A. Katsnelson and H. Mohseni, “A Novel Self-aligned and Maskless Process for Formation of Highly Uniform Arrays of Nanoholes and Nanopillars”, *Nanoscale Research Letters*, 3(3), 123 (2007).
- 15) W. Wu, A. Katsnelson, **O. G. Memis**, and H. Mohseni, “A deep sub-wavelength process for the formation of highly uniform arrays of nanoholes and nanopillars”, *Nanotechnology*, 18, 485302 (2007)
- 16) **O. G. Memis**, A. Katsnelson, S.-C. Kong, H. Mohseni, M. Yan, S. Zhang, T. Hossain, N. Jin, and I. Adesida, “A photon detector with very high gain at low bias and at room temperature,” *Appl. Phys. Lett.* 91, 171112 (2007)

## CONFERENCE PAPERS

- 1) I. Hassani, **O.G. Memis**, J. Kohoutek, R. Gelfand, H. Mohseni, "Surface plasmon enhancement of photon extraction efficiency by silver nanoparticles: with applications in laser cooling of semiconductors," SPIE Optics+Photonics (2012).
- 2) J. Kohoutek, D. Dey, A. Bonakdar, R. Gelfand, V. Fathipour, **O. G. Memis**, H. Mohseni, "Nano-opto-mechanically modulated plasmonic nanoantenna-integrated quantum cascade laser," SPIE Optics+Photonics (2012).
- 3) J. Kohoutek, A. Bonakdar, D. Dey, R. Gelfand, I. Hassani, **O. G. Memis**, V. Fathipour, H. Mohseni, "Antenna integrated quantum cascade laser switchable via telecommunications wavelength probe beam" SPIE Optics+Photonics (2012).
- 4) **O. G. Memis**, H. Mohseni, "New generation of isolated nano-injection detectors and imagers," Information Optics (WIO), 2011 10th Euro-American Workshop on , 1-3, (2011).
- 5) D. Dey, J. Kohoutek, A. Bonakdar, R. M. Gelfand, **O. G. Memis**, H. Mohseni, "Plasmonic antenna integrated Quantum Cascade Laser for mode confinement used for high sensitivity bio-sensing applications," Photonics Conference (PHO), 2011 IEEE , 77-78, (2011).
- 6) J. Kohoutek, D. Dey, A. Bonakdar, A. Sklar, **O.G. Memis**, R. Gelfand, H. Mohseni, " Opto-mechanical force measurement of deep sub-wavelength plasmonic modes", Proceeding of SPIE, Paper No. 8097-63 (2011).
- 7) J. Kohoutek, D. Dey, A. Bonakdar, R. Gelfand, A. Sklar, **O.G. Memis**, H. Mohseni, "Optical Force Mapping of Plasmonic Modes Generated by a Nanoantenna", IEEE Photonics Society, IPC 2011, Paper No. MX 5 (2011).
- 8) **O.G. Memis**, J. Kohoutek, W. Wu, R.M. Gelfand, and H. Mohseni, "Short-Wave Infrared Nano-Injection Imaging Sensors ", IEEE Sensors 2010, 1765 (2010).
- 9) W. Wu, D. Dey, **O. G. Memis**, and H. Mohseni, "Modeling of an Electrically Tunable Quantum Dot Photodetector for Terahertz Detection", Proc. SPIE, Vol. 7601, 760109, (2010).
- 10) **O. G. Memis**, J. Kohoutek, D.Dey, W.Wu and H. Mohseni, "Resonant Tunneling Injection Detector and Imagers," IEEE Photonics Society, 22nd Annual Meeting of the, TuCC2, 47, (2009).
- 11) Dibyendu Dey, Wei Wu, **Omer G. Memis**, and Hooman Mohseni, "Design and Simulation of an Electrically Tunable Quantum Dot Cascade Laser", Proc. SPIE, Vol. 7406, 74060Q, (2009).
- 12) H. Mohseni, J. Kohoutek, and **O. G. Memis**, "A Novel Opto-electro-mechanical Photon Sensor", Proc. SPIE, Vol. 7222, 72220S, (2009).
- 13) D. Dey, W. Wu, **O. G. Memis**, H. Mohseni, "Injectorless Quantum Cascade Laser with very Low Voltage-Defect Grown by Metal-Organic Chemical Vapor Deposition," IEEE Lasers and Electro-Optics Society, 21st Annual Meeting of the, 800, (2008).
- 14) **O. G. Memis**, W. Wu, D. Dey, A. Katsnelson, H. Mohseni, "A High-Gain Low-Noise Single-Photon Detector for SWIR", Government Microcircuit Applications and Critical Technology Conference, Nanosensor Tech II 5.1, (2008).
- 15) W. Wu, D. Dey, **O. G. Memis**, A. Katnelson and H. Mohseni, "Electrically Confined Quantum Dot Intersubband Optoelectronic Devices," IEEE Lasers and Electro-Optics Society, 21st Annual Meeting of the, 618, (2008).
- 16) J. Kohoutek, **O. G. Memis** and H. Mohseni, "An Optoelectromechanical Light Sensor at 1.55  $\mu\text{m}$ ," IEEE Lasers and Electro-Optics Society, 21st Annual Meeting of the, 719, (2008).
- 17) **O. G. Memis**, A. Katsnelson and H. Mohseni, "Low Noise, High Gain Short-Wave Infrared Nano-Injection Photon Detectors with Low Jitter," IEEE Lasers and Electro-Optics Society, 21st Annual Meeting of the, 159, (2008).
- 18) W. Wu, D. Dey, **O.G. Memis**, A. Katsnelson and H. Mohseni, "A novel self-assembled and maskless technique for highly uniform arrays of nano-holes and nano-pillars", NSTI Nanotech 2008, 1, 574-577, (2008).
- 19) (**Invited**) **O. G. Memis**, A. Katsnelson, H. Mohseni, M. Yan, S. Zhang, T. Hossain, N. Jin, I. Adesida, "A bio-inspired single photon detector with suppressed noise and low jitter", Proceeding of SPIE Vol. 7035, 70350V, (2008).
- 20) W. Wu, D. Dey, **O. G. Memis**, A. Katsnelson, H. Mohseni, "A novel lithography technique for formation of large areas of uniform nanostructures", Proceeding of SPIE Vol. 7039, 70390P, (2008).

- 21) W. Wu, D. Dey, **O.G. Memis**, A. Katsnelson and H. Mohseni, "A novel self-aligned and maskless process for formation of highly uniform arrays of nano-holes and nano-pillars"; Joint Conferences on Interaction Among Nanostructures, IAN005V (2008).
- 22) H. Mohseni, **O. G. Memis**, S.C. Kong, A. Katsnelson, and W.Wu, "A Novel SWIR Detector with an Ultra-high Internal Gain and Negligible Excess Noise", Proc. SPIE 6737, 67370W (2007)
- 23) **O.G. Memis**, W. Wu, D. Dey, A. Katsnelson, H. Mohseni, "A type-II near-infrared detector with very high stable gain and low noise at room temperature"; Semiconductor Device Research Symposium, International, 1-2, (2007).
- 24) **O.G. Memis**, W. Wu, D. Dey, A. Katsnelson and H. Mohseni, "Detailed Numerical Modeling of a Novel Infrared Single Photon Detector for  $\lambda > 1\mu\text{m}$ ", 7th International Conference on Numerical Simulation of Optoelectronic Devices, 63-64, (2007).
- 25) **O. G. Memis**, S.C. Kong, A. Katsnelson, M.P. Tomamichel, and H. Mohseni, "A Novel Avalanche-free Single Photon Detector," Sixth IEEE Conference on IEEE-NANO 2006. Volume 2, pp. 742 - 745, (2006).
- 26) **O. G. Memis**, S.C. Kong, A. Katsnelson, P.A. Behr and H. Mohseni, "Novel Type-II Infrared Single Photon Detector," Proceedings of IEEE Laser and Electro-Optics Society Summer Topical Meeting, pp. 29-30, (2006).
- 27) H. Mohseni, **O.G. Memis**, and S.C. Kong, "A Novel Avalanche-Free Single Photon Detector," IEEE Proceedings of Indium Phosphide and Related Material, TuA2.1 (2006).
- 28) H. Mohseni, **O. G. Memis**, S. C. Kong, A. Katsnelson, "A novel nano-injector-based single-photon infrared detector," Proceedings of SPIE, Vol. 6243 , Enabling Photonics Technologies for Defense, Security, and Aerospace Applications II, pp. 242-247, (2006).
- 29) **O. G. Memis**, O. Aytur, E. Atalar, "Optical transmission of MRI signals: A safe alternative for internal MRI probes", Proceedings of ESMRMB 20th Annual Scientific Meeting, (2003).