

Eunseong Moon

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Research Interests

- “I am interested in investigating novel optoelectronic devices and their integration with CMOS technologies for the next generation of hardware architecture, and currently exploring from device physics to fabrication & process integration.”

Research Highlights

- **Monolithic photovoltaic and μ -LED module for brain-machine interfaces:** Hardware demonstration of monolithically integrated microscale LED and photovoltaic module for brain-machine interfaces was published in *International Solid-State Circuits Conference (ISSCC – Top-tier peer-reviewed conference in solid-state circuits)* (2nd author, Feb. 2020).
- **Energy harvesting for IoT:** Development of indoor photovoltaic energy harvesters for self-powered IoT systems was published in *Progress in Photovoltaics: Research and Applications*, featured on the journal cover (1st author, Mar. 2019).
- **Optoelectronic devices for bio-implantable devices:** Development of high-efficiency infrared silicon and GaAs photovoltaic cells for fully wireless bio-implantable devices was published in *IEEE Transactions on Electronic Devices* (1st author, Sep. 2017).
- **Current Projects:** 1) Optical power transfer and data communications for neural recording units
2) 3D vertical integration of silicon CMOS and III-V optoelectronic devices for IoT

Education

- **Ph. D** (May. 2015 ~ May.2020): **Electrical & Computer Engineering, University of Michigan, Ann Arbor**
 - Prof. Jamie Phillips’ group: New optoelectronic devices for novel applications
 - GPA: 3.975/4.0 & Thesis: *Photovoltaic energy harvesting for millimeter-scale systems*
- **Master of Science** (Sep. 2013 ~ Apr. 2015): **Electrical & Computer Engineering, University of Michigan, Ann Arbor**
 - GPA: 3.975/4.0 & Subjects: *Solid state physics, Electronic and optoelectronic properties of semiconductor*
- **Bachelor of Science** (Mar. 2006 ~ Feb. 2012): **Electrical Engineering, Chung-Ang University, South Korea**
 - Graduated with honors (GPA: Overall 4.12/4.5, Major 4.3/4.5)

Research & Working Experience

- Jun. 2020 ~ Present : Postdoctoral research fellow (Prof. Jamie Phillips), University of Michigan, Ann Arbor
- May. 2014 ~ May. 2020 : Research assistant (Prof. Jamie Phillips), University of Michigan, Ann Arbor
- Jul. 2012 ~ Dec. 2012 : Research assistant (Prof. Kangwook Kim), Gwangju Institute of Science and Technology, South Korea

Technical Skills

- **Device/circuit Modeling & Software Skills:**
 - Optoelectronic device and transistor simulation: Silvaco, Synopsys TCAD (Sentaurus)
 - Circuit Simulation: SPICE (LTspice, Pspice)
 - Layout design: AutoCAD, IC Station
 - C/C++, Matlab, MS Office, Origin, 3DSMax
- **Device Fabrication & Process Integration:**
 - Photolithography, Dry etching (RIE), Through-wafer via (DRIE), Wet etching, Mask maker, Thin film deposition (CVD, PECVD, LPCVD, ALD, PVD), Rapid thermal annealing (RTA)
 - Metrology & packaging tools: Profilometer, Dicing saw, Wire bonder, Wafer thinning and soldering tools
- **Material & Device Characterization:**
 - Semiconductor parametric analyzer (I-V, C-V), Oscilloscope
 - SEM, AFM, Optical spectroscopy (FTIR/UV-Visible), Hall measurement, Photoluminescence (PL)
- **Epitaxial Layer Design:**
 - Epitaxial layer design for III-V (GaAs, InP) PV and LED structures using MBE, MOCVD

Awards

- **Recognition from the President of Chung-Ang University for highest GPA**, (Feb. 2012)
- **Korea Post Honor Scholarship**, (2010)
- **Department Honor Scholarship**, Chung-Ang University (2006 - 2012)

Publications

• Conference presentations:

1. Eunseong Moon, Michael Barrow, Jongyup Lim, David Blaauw, Jamie Phillips, "Monolithically Integrated Microscale LED and Photovoltaic Module for Energy Harvesting and Data Communication in Bio-implantable Devices", 78th Virtual Device Research Conference (2020).
2. Jongyup Lim, Eunseong Moon, Michael Barrow, Samuel R. Nason, Paras R. Patel, Parag G. Patil, Sechang Oh, Inhee Lee, Hun-Seok Kim, Dennis Sylvester, David Blaauw, Cynthia A. Chestek, Jamie Phillips, Taekwang Jang, "A $0.19 \times 0.17 \text{ mm}^2$ Wireless Neural Recording IC for Motor Prediction with Near-Infrared-Based Power and Data Telemetry", International Solid-State Circuits Conference (ISSCC), San Francisco (2020).
3. Eunseong Moon, Michael Barrow, Inhee Lee, David Blaauw, Jamie D. Phillips, "GaAs Dual Junction Photovoltaic Modules for Bio-implantable Devices", 61st Electronic Materials Conference, Ann Arbor, Michigan (2019).
4. Inhee Lee, Eunseong Moon, Yejoong Kim, Jamie Phillips, David Blaauw, "A 10-mm^3 Light-Dose Sensing IoT^2 System with 35-to-339nW 10-to-300klx Light-Dose-to-Digital Converter" In 2019 IEEE Symposium on VLSI Circuits, Kyoto, Japan, (2019).
5. Eunseong Moon, Inhee Lee, David Blaauw, Jamie D. Phillips, "Photovoltaic Modules on a Chip for mm-Scale Wireless Sensor Systems", 60th Electronic Materials Conference, Santa Barbara, California (2018).
6. Inhee Lee, Gyouho Kim, Eunseong Moon, Seokhyeon Jeong, Dongkwun Kim, Jamie Phillips, David Blaauw. "A 179-Lux Energy-Autonomous Fully-Encapsulated 17-mm^3 Sensor Node with Initial Charge Delay Circuit for Battery Protection." In 2018 IEEE Symposium on VLSI Circuits, pp. 251-252. IEEE, (2018).
7. Eunseong Moon, David Blaauw, Jamie D. Phillips, "Photovoltaic Infrared Energy Harvesting for Bio-Implantable Devices", 59th Electronic Materials Conference, South Bend, Indiana (2017).
8. Eunseong Moon, David Blaauw, Jamie D. Phillips, "Low-flux Photovoltaic Harvesting for mm-scale Wireless Sensor Systems", 58th Electronic Materials Conference, Newark, Delaware (2016).
9. Eunseong Moon, Jamie D. Phillips, "Silicon Photovoltaics for Infrared Energy Harvesting in mm-Scale Systems", 57th Electronic Materials Conference, Columbus, Ohio (2015).

• Journal publications:

1. Eunseong Moon, Inhee Lee, David Blaauw, and Jamie D. Phillips. "High-efficiency photovoltaic modules on a chip for millimeter-scale energy harvesting." Progress in Photovoltaics: Research and Applications (2019) & featured on the cover (Journal cover: doi:10.1002/pip.3132)
2. Eunseong Moon, David Blaauw, and Jamie D. Phillips. "Infrared Energy Harvesting in Millimeter-Scale GaAs Photovoltaics." IEEE Transactions on Electron Devices (2017).
3. Eunseong Moon, David Blaauw, and Jamie D. Phillips. "Subcutaneous Photovoltaic Infrared Energy Harvesting for Bio-implantable Devices." IEEE Transactions on Electron Devices (2017).
4. Eunseong Moon, David Blaauw, and Jamie D. Phillips. "Small-Area Si Photovoltaics for Low-Flux Infrared Energy Harvesting." IEEE Transactions on Electron Devices 64, no. 1 (2017): 15-20.
5. Alan S. Teran, Eunseong Moon, Wootae Lim, Gyouho Kim, Inhee Lee, David Blaauw, and Jamie D. Phillips. "Energy harvesting for GaAs photovoltaics under low-flux indoor lighting conditions." IEEE Transactions on Electron Devices 63, no. 7 (2016): 2820-2825.
6. Matt DeJarld, Alan Teran, Marta Luengo-Kovac, Lifan Yan, Eunseong Moon, Sara Beck, Cristina Guillen, Vanessa Sih, Jamie Phillips, and Joanna Mirecki Milunchick. "The effect of doping on low temperature growth of high quality GaAs nanowires on polycrystalline films." Nanotechnology 27, no. 49 (2016): 495605.
7. Sucheta Sengupta, Tzvi Templeman, Chihyu Chen, Eunseong Moon, Michael Shandalov, Vladimir Ezersky, Jamie Phillips, and Yuval Golan. "Chemical epitaxy and interfacial reactivity in solution deposited PbS on ZnTe." Journal of Materials Chemistry C 4, no. 10 (2016): 1996-2002.

• Book chapter:

1. Jamie D. Phillips, Eunseong Moon and Alan Teran. "Indoor Photovoltaics Based on AlGaAs." Scrivener Publishing, (2020). (Accepted, pending publication)

• Patent:

1. David Blaauw, Jamie D. Phillips, Cynthia Chestek, Taekwang Jang, Hun-Seok Kim, Dennis Sylvester, Jongyup Lim, Eunseong Moon, Michael Barrow, Samuel Nason, "A wireless neural recording system with two-step communication and power delivery." (2019) (Filed, patent pending, Track code: OI2020-00102).