

Dennis Rich

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EDUCATION

Stanford University

PH.D - ELECTRICAL ENGINEERING

GPA: 4.0/4.0

Expected June 2024

University of Illinois at Urbana-Champaign

DUAL B.S. - ELECTRICAL ENGINEERING AND ENGINEERING PHYSICS

GPA: 4.0/4.0

Conferred May 2019 with Highest Honors

RESEARCH EXPERIENCE

Robust Systems Group - Prof. Subhasish Mitra

PROJECT LEADER

Stanford University

May 2019 - Present

Drive interdisciplinary efforts towards system-scale methods of cooling future 3D IC architectures.

- Automated IC thermal analysis with 3D-ICE, COMSOL, and Python to quantify parameter impacts in 100,000+ systems
- Derived IC interconnect analytical model from thermal fin equation for 15% more accurate self-heating calculations
- Developed LabView IC testing environment for 1.4Mb phase-change memory arrays to investigate new write strategies

Innovative Compound Semiconductor Lab - Prof. Can Bayram

PROJECT LEADER

University of Illinois

October 2015 - March 2019

Develop processes to produce and characterize flexible thin-film devices from brittle materials.

- Led team in development of original fabrication processes and instruments for controlling substrate stress
- Over 250 class 1000 cleanroom hours performing:
 - e-beam evaporation • profilometry • Masked wet etching • Optical stress measurement
- Over 500 hours fabricating and characterizing semiconductors with:
 - SEM • Raman spectroscopy • Nomarski microscopy • Ni-on-Si electroplating • Mechanical thin-film separation • Optical microscopy profiling • Nanoindentation • Atomic force microscopy

Silicon Labs

DESIGN INTERN

Nashua, NH (Timing Division)

May 2017 - August 2017

- Designed new splitting techniques for preserving signal integrity in PCB-based transmission lines
- Analyzed and diagnosed circuitry and layout deficiencies in phase-locked loop designs

Patankar Research Group - Prof. Neelesh Patankar

COMPUTATIONAL ANALYTICS RESEARCHER

Northwestern University

May 2014 – August 2014

- Created original molecular simulations with CHARMM and Visual Molecular Dynamics
- Programmed efficient free energy analysis in C++ of large datasets (tens of gigabytes) obtained from simulation
- Designed unique mathematical methods of calculation based on self-taught knowledge of thermodynamics

Mesoscopic Physics Group - Prof. Venkat Chandrasekhar

LABORATORY RESEARCHER

Northwestern University

May 2013 – August 2013

- Refined CVD materials, methods, and temperatures with self-taught knowledge framework
- Analyzed samples and confirmed that goal of strongly thermoelectric samples was achieved
- Programmed a unique GUI to automate the refined process, allowing for scalability and variation
- Over 30 class 100 cleanroom hours performing wet CNT substrate processing, AFM, SEM, and CVD

AWARDS AND HONORS

Edward J. McCluskey Graduate Fellowship - Awarded to Ph.D students in computer architectures

2019-2020

Goldwater Scholarship - Nationally competitive annual award given to 240 promising researchers

2017-2019

John Bardeen Undergraduate Award - One outstanding senior selected for excellence in semiconductor research

2019

SPIE BACUS Scholarship - Awarded to one promising graduate student in optics and photonics

2019

Robert C. MacClinchie Scholarship - \$30,000 awarded to one senior for leadership and academic merit

2018

Campus Honors Program Outstanding Senior - Awarded to 16 members of highest honors program at UIUC

2018

Undergraduate/Honors Research Support Grant - Two grants to pursue an outstanding research proposal

2018

Michael E. Napier Memorial Award - Awarded for excelling in academics while working to finance an education

2018

Ford Foundation Engineering Scholar - 100 freshmen selected from 7,000 for merit-based scholarship

2015-2016

PUBLICATIONS AND PRESENTATIONS

| | |
|---------------|--|
| Published | <i>Heterogeneous 3D Nano-systems: The N3XT Approach?</i> Dennis Rich et. al. in <i>NANO-CHIPS 2030: On-Chip AI for an Efficient Data-Driven World</i> , B. Murmann et al., Springer (2020) <i>The Thermodynamics of Restoring Underwater Superhydrophobicity</i> Paul Jones, Adrian Kirn, Y. David Ma, Dennis Rich, and Neelesh Patankar. <i>Langmuir</i> (2017) 33 (11) |
| Expected | <i>Fast Thermal Simulation of Monolithically Interspersed Logic and Memory</i> Dennis Rich, Mehdi Ashegi, Subhasish Mitra et al. Expected publication 2021. <i>Novel Write Strategies for Multiple-Bits-Per-Cell Phase-Change Memory</i> Dennis Rich, Binh Le, Subhasish Mitra et al. Expected publication 2021. |
| Presentations | <i>N3XT Heterogeneous Integration: From Lab to Fab</i> Dennis Rich, Robert Radway, Subhasish Mitra et al. <i>SystemX November Conference</i> 2019 <i>Thermal Frameworks for N3XT Architectures</i> External talks with representatives of Intel, SRC, DARPA, Brookhaven - 2019-2020 <i>Controlled Spalling: A Universal Mechanical Release Technology For Thin-Film Devices</i> External talks with NASA, U.S. Naval Research Laboratory, Air Force Research Laboratory (2016-2019) <i>Controlling Phase Change: Drying-Up Under Water or Staying Wet During Boiling</i> Paul Jones, Adrian Kirn, Dennis Rich, Ashley Elliot, Neelesh Patankar. <i>Bull. Am. Phys. Soc.</i> (2014) 59 |

SKILLS

Laboratory Skills

Fabrication

E-beam evaporation • Electroplating • Thin-film separation • Photolithography • Wet etching and cleaning

Characterization

AFM • SEM • Profilometry • Raman spectroscopy • Nomarski microscopy • Optical stress measurement • Nanoindentation

Software Skills

Electronic Devices

COMSOL Heat Transfer Module • Lumerical Photonic Simulation

Electronic Systems

Calibre IC Verification • KLayout IC Layout • 3D-ICE Thermal Simulator

Deep Learning, Circuits, Molecular Simulation

C++ • Python • PyTorch • HTML/Javascript • Eagle Circuit CAD • Spice • Autodesk Inventor • Visual Molecular Dynamics • CHARMM molecular simulation

Coursework

Advanced Fabrication Laboratory
Modern Integrated Circuits Technology
Thermal Energy In Electronics
Deep Learning
Computer Systems Architecture
Advanced VLSI Devices
Emerging Non-Volatile Memory Devices
Photonic Device Laboratory
Condensed Matter Physics
Quantum Mechanics I and II
Linear Algebra
Group Theory
Statistical Methods II
Electronic Circuits with Laboratory
Advanced Classical Mechanics

LEADERSHIP AND OUTREACH

Nanoscience Summer Institute for Middle School Teachers

Stanford University

RESEARCH AMBASSADOR

June 2020 - Present

- Proposed and presented middle-school friendly demonstrations of concepts core to my research topics

Display Electronics - Formula Electric Racing

University of Illinois

DESIGN LEADER

September 2015 - May 2017

- Designed and soldered PCBs to approximate speed with a differentiator and detect faults with a novel use of a 555 timer
- Guided members through a rigorous circuit design process, evaluating results and giving constructive feedback

Guatemala Water Project - Engineers Without Borders

University of Illinois

PROJECT LEAD

September 2015 - March 2019

- Managed design flow and tutored engineering students to create water delivery infrastructure
- Obtained Northrop Grumman \$10,000 grant based on demonstrated design and community partnerships