Purdue-Indy Faculty Meeting

We, 2025 Apr 09

PURDUE UNIVERSITY®

PURDUE ENGINEERING IN INDIANAPOLIS
DISTINGUISHED LECTURE SERIES

A WORLD OF WEIRD:

NUCLEAR MAGNETIC RESONANCE (NMR) & MAGNETIC RESONANCE IMAGING (MRI) AT 6.5 mT

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MASS GENERAL/MARTINOS CENTER FOR BIOMEDICAL IMAGING
HARVARD MEDICAL SHOOL

Abstract: A promising approach to portable magnetic resonance imaging (MRI) is operation at low magnetic fields, where cost-effective electromagnets and simple permanent magnet arrays become practical. However, MRI in the low- (<0.1 T) and ultra-low-field (<0.01 T) regimes is inherently challenging due to intrinsically low Boltzmann polarization, leading to low signal-to-noise ratio (SNR). Despite these limitations, we have developed signal acquisition and processing techniques that enhance SNR and image quality in scanners operating as low as 6.5 mT (0.0065 T). Machine learning (ML) has emerged as a critical enabler of low-field MRI, leveraging low-cost embedded GPUs for real-time data processing. We will present ML-based approaches for reducing noise, increasing attainable information per unit time, and solving highly undersampled,low-SNR inverse problems, including our deep learning domain transformation method, AUTOMAP, and its role in improving image reconstruction. We will also explore ML-driven strategies for optimal experimental design, with applications in both MRI and NMR spectroscopy, demonstrating cases where AI-enhanced low-field methods rival or surpass high-field performance in specific tasks. In clinical applications, we will showcase the use of super-resolution techniques to improve segmentation in bedside neuroimaging at 64 mT. We will highlight both the promise and the limitations of ML in portable MRI, addressing challenges in robustness, interpretability, and clinical deployment. In addition, we will discuss several classes of MRI and even NMR spectroscopy experiments enabled by operation at low magnetic field, which can outperform what can be done with high-field instruments.

Short Bio: Dr. Matt Rosen is a physicist, tool-builder and inventor whose research bridges the spectrum from fundamental physics to applied bioimaging work in the field of MRI. The Rosen Lab focuses on new methods and tools to enable unconventional approaches to MRI scanner construction. In addition, Dr. Rosen Co-directs the Center for Machine Learning at the Martinos Center. Dr. Rosen is a Fellow of the American Physical Society, a Fellow of the International Society of Magnetic Resonance in Medicine and was named Distinguished Investigator by the Academy for Radiology & Biomedical Imaging Research in 2023. He is the Kiyomi and Ed Baird MGH Research Scholar, and an Associate Professor of Radiology at Harvard Medical School. He is the Founder of five companies including Hyperfine, which has developed the world's first portable MRI scanner which can be used at the patient bedside by virtue of its operation at low magnetic field. He has served on the scientific advisory boards of nine companies since 2014. He is the Startup Innovation Expert for MGB Enterprise Radiology (ERIE).

FRIDAY, APRIL 18TH ▪ 2:00 PM EST
INNOVATION HALL (IO) 105, PURDUE INDY

REFRESHMENTS WILL BE SERVED PRIOR TO THE TALK

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College of Engineering

HTTPS://PURDUE-EDU.ZOOM.US/J/95966677729
MEETING ID: 959 6667 7729

- Looking for people to meet with Dr. Rosen.
- Contact Carlos

Updated Purdue-Indy Enrollment Numbers

Yield Ranges for 2025
WL 2394 - 2966
IN 375 - 510

ME + MSPE

Applications ONLY

3/31/2025	Res	Non-Res	Intl	2025 Totals
WL	**1,930**	**22,751**	**4,966**	**29,647**
IN	**294**	**3,338**	**955**	**4,587**
BME	29	458	156	643
CMPE	39	414	202	655
ECEB	26	415	142	583
MECH	105	1,422	377	1,904
MSPE	95	629	78	802
			Combined Totals	**34,234**

2024 Applications
1688
450

Accepts Only — ***Admitted & Committed to Purdue***

3/31/2025	Res	Non-Res	Intl	2025 Totals
WL	**510**	**388**	**43**	**941**
IN	**63**	**88**	**27**	**178**
BME	6	4	4	14
CMPE	6	3	4	13
ECEB	3	14	5	22
MECH	23	25	12	60
MSPE	25	42	2	69
			Combined Totals	**1,119**

Admits Only — ***Admitted = Not yet Committed to Purdue***

3/31/2025	Res	Non-Res	Intl	2025 Totals
WL	**1,097**	**6,325**	**604**	**8,026**
IN	**134**	**1,549**	**443**	**2,126**
BME	16	225	71	312
CMPE	14	185	83	282
ECEB	9	203	71	283
MECH	55	656	187	898
MSPE	40	280	31	351
			Combined Totals	**10,152**

2024 Admitted	2024 Enrolled
1238 (73.3%)	242 (19.5%)
284 (63.1%)	105 (37.0%)

Student Community Building

- The Tutorial Room (EL 104) will be turned into graduate student offices.
  - A different Tutorial Room, location TBD, will be used next semester.
  - We need to have a place where students collaborate and form peer networks. We need to increase faculty-student interaction.
- Free Food Friday
  - Fr, Mar 02 from 10:00 A.M. – noon in the ET Atrium (Zach is coordinating. Cookies!)
- Pizza with a Professor
  - Previous faculty: Carl Wassgren (Jan); Austin McDonald (Feb); Whitney Yu (Mar)
  - Hosop has volunteered for Tu, Apr 29, noon – 1:00 P.M. in SL 174A.
- ME + MSPE will be given a budget to support Indy student organizations
  - Motorsports Club is already active
  - ASME call-out: Tu, Apr 15 from 5:30 – 7:30 P.M. in ET 125
- Will create a senior photo composite.
- ME Student Forum
  - Opportunity for students to provide input to the School
  - When should we hold it? We, Apr 30 at 5:00 – 6:00 P.M.? (during Quiet Week)

Teaching Load for Fa25/Sp26

- *ME Teaching Load Model* – available on the "ME School Policies & Procedures" intranet page
- ME-Indy faculty are considered "new hires".

Faculty who are newly hired into the School of ME as Assistant Professors (Pre-Tenure) are exempt from the above AY salary support model for a certain period of time as outlined here:

- 33% teaching load for the first 3 years at 0% AY Salary Support
- 33% teaching load for years 4, 5 and 6 at 5% AY Salary Support, or
  50% teaching load for years 4, 5 and 6 at 0% AY Salary Support
- After 6 years or after receiving tenure, whichever comes first, the teaching load model as outlined in Figure 1 applies.

Faculty who are newly hired into the School of ME as Associate or Full Professors with Tenure are exempt from the above AY salary support model for a certain period of time as outlined here:

- 33% teaching load for the first year at 0% AY Salary Support
- 33% teaching load for the second year at 5% AY Salary Support, or
  50% teaching load for the second year at 0% AY Salary Support
- After 2 years, the teaching load model as outlined in Figure 1 applies.

- 33% teaching load = two typical 3 cr lecture courses per AY
- 50% teaching load = three courses per AY

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Other Items

- Guidance for assigning research lab access and graduate student desks sent by Jun Chen.
  - For UG research access, contact me. Will evaluate: 1) lab hazards and (2) previous UG experience
- Quiet Week reminder: Mo, Apr 28 – Sa, May 03
  - If you have an assessment(s) during the final examination period (e.g., final exams, projects, etc.), you cannot administer assessments during the Quiet Period that are worth any point value (grades) in the course. This rule does not apply to your course if there are no assessments during the final examination period. An assessment is defined as activities relating to the course's learning objectives, which students submit for class credit that the course instructor intends to use to judge whether students have met the associated learning objectives.
- Faculty/staff office review – potentially affects lecturers and staff
  - https://www.purdue.edu/auxiliary-services/documents/jll-space-guidelines.pdf
- Evening exam requests
- Opportunities for ME research thrust areas at Indy?
  - Automotive/Motorsports Engineering
  - Sustainable Energy & Energy Storage
  - Advanced Manufacturing
  - Biomedical /Pharmaceutical Applications
  - Sports Engineering
- Next Purdue-Indy faculty meeting: We, 2025 May 07, 10:00 – 11:00 A.M.

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