Oregon State University

COLLEGE OF ENGINEERING

College of Engineering & Honors College Thesis Mixer

The OPEnS Lab

DSI UG Cert

Chet Udell
udellc@oregonstate.edu
John S. Selker
John.Selker@Oregonstate.edu
open-sensing.org

Do Any Describe You?

- **Motivated Maker** - Utilize Design Principles in your career path
- **Impatient Change Agent** - Tackling challenges in community and globally
- **Synthesizer** - Opting for both-and instead of this-or-that. Porque no los dos?
- **Enthusiastic Entrepreneur** - Client-driven product-focused

Hands-On, Collaborative, Impact

- ✓ *Solve real-world problems for real-world clients*
- ✓ *Co-Design with peers across disciplines*
- ✓ *Learn New Skills*
- ✓ *Climate, Environment, Hazards, Sustenance, Accessibility*
- ✓ *Community-Engaged: Native Tribes, Deaf and Hard of Hearing, Scientists*

The OPEnS team

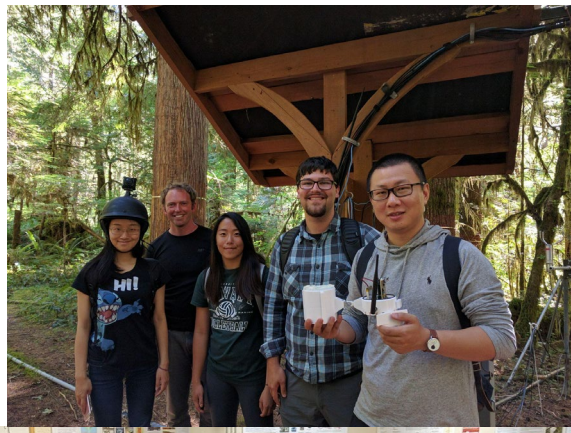
97% undergraduate employees (~35)

Teams:

- Electrical
- Programming
- Mechanical
- Bio/Eco/Env

Dr. John Selker

Dr. Chet Udell



Design for Social Impact

Undergraduate Certificate

- ✓ *27 Credits*
- ✓ *Focus Areas:*
  - *Sustainability*
  - *Technological Innovation in the Arts*
  - *Social Change*
  - *Transdisciplinary Society*
- ✓ *Translate knowledge into action for the greater good*
- ✓ *Apply design thinking to solve complex problems*
- ✓ *Integrate social justice and responsibility perspectives*
- ✓ *Develop communication skills across diverse audiences*

Thank You

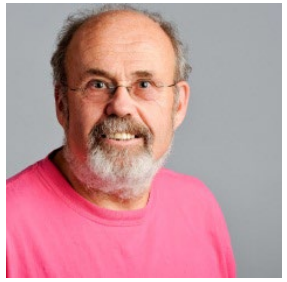
udellc@oregonstate.edu

COE HC Research Showcase Fall 2022

Oregon State University
College of Engineering

Teaching

- *Process Engineering Senior Lab*
- *Polymer Science &Engineering*
- *Transport Phenomena (3rd Yr CBEE)*
- *UHC Colloquia –*
  - *Plastics for Poets (Sp)*
  - *Energy IQ (W)*
  - *STEM Outreach (Sp)*



Skip Rochefort

School of Chemical, Biological, and Environmental Engineering

Gleeson 205

541-231-6768 (text only)

skip.rochefort@oregonstate.edu

AIChE Fellow

CBEE Student Chapter Advisor (30 years)

Research

Anything related to POLYMERS!

> 45 yrs research/ 30 yrs OSU

Plastics Processing and Recycling

Biomaterials

Environmental Sustainability

K-12 Outreach

Thesis Topic Ideas/Opportunities

Note: Typically 15-20 UG Researchers

- ***Waste Plastics to Fuel (Pyrolysis/Gasification)***
- ***Encapsulation of bacteria for bioremediation***
- ***Plastic/Hemp Composite Filament 3D Printing***
- ***PFAS in the Environment***

POWERED BY ORANGE

Rochefort Polymer Lab Research Projects – March 2022

- ***Waste Plastics to Diesel Fuel (PTF)***

- **NIEHS- R01 $1.5 million/4yrs Hydrogel Bead Encapsolation of Microbes to *Treat Contaminant Mixtures in groundwater***

- ***SERDP $1.52 million/4yrs Quantification and Identification of PFAS and Total Fluorine during Thermal Degradation of Fluoropolymers in the Presence of Explosives***

- ***Bioplastic/Hemp Composites for Injection Molding and 3D Printing Filament***

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Rochefort Polymer Lab

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PTF COE Expo 2023 - Sponsors

Polymer Group Weekly Meeting

Oregon State UNIVERSITY

Rochefort Polymer Lab

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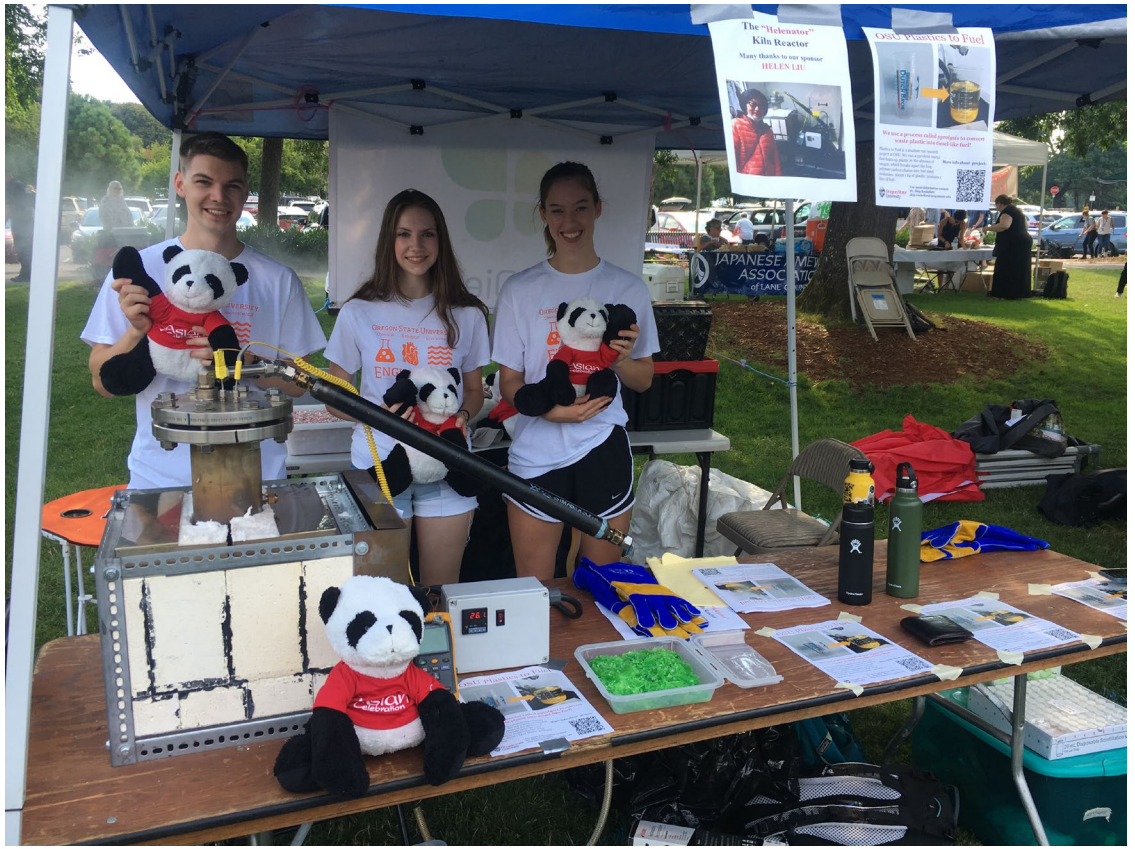
Believe It Campaign – PTF

https://oregonstate.edu/believe-it



ASIAN Festival (Eugene) PTF Demo

Oregon State UNIVERSITY

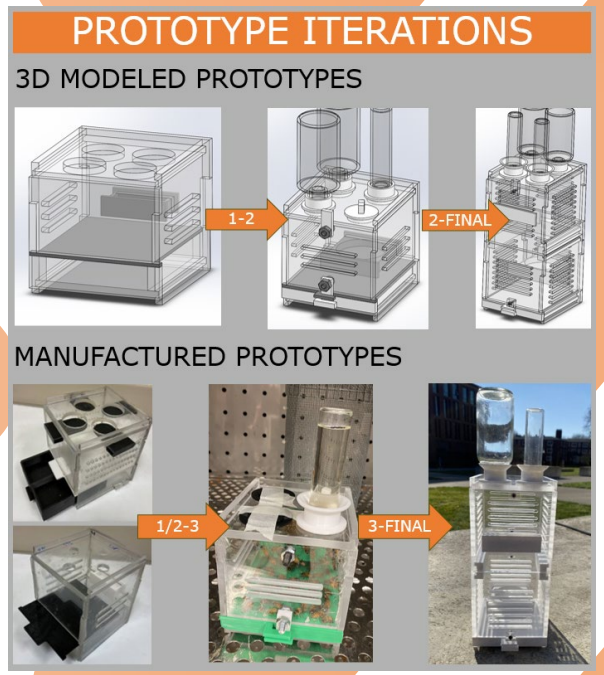
Dr. Sarah Oman

School of Mechanical, Industrial, and Manufacturing Engineering

Rogers 426

sarah.oman@oregonstate.edu

MIME Senior Design Coordinator



Honors Collaboration Interests

- **Engineering Education research**
  - **Main Focus:**
    - **LGBTQ+ topics**
    - **neurodivergent topics**
  - **Can tailor specific topic based on student interest**
- **Combining MIME Capstone project with Honors Thesis**

Supporting Honors Theses w/ MIME Capstone Design

Fall

Fall MIME 497

- Lit. Review, Determine Thesis scope

Winter

Winter MIME 498

- Complete capstone, work on start of Thesis concurrently

Spring

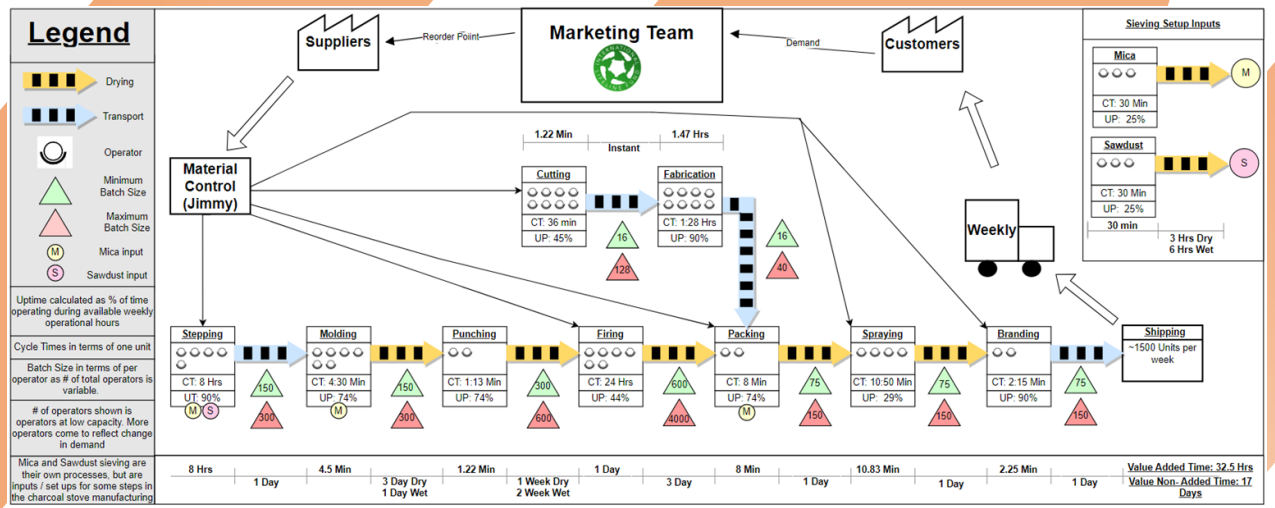
Spring ME 406

- Project analysis, write and present

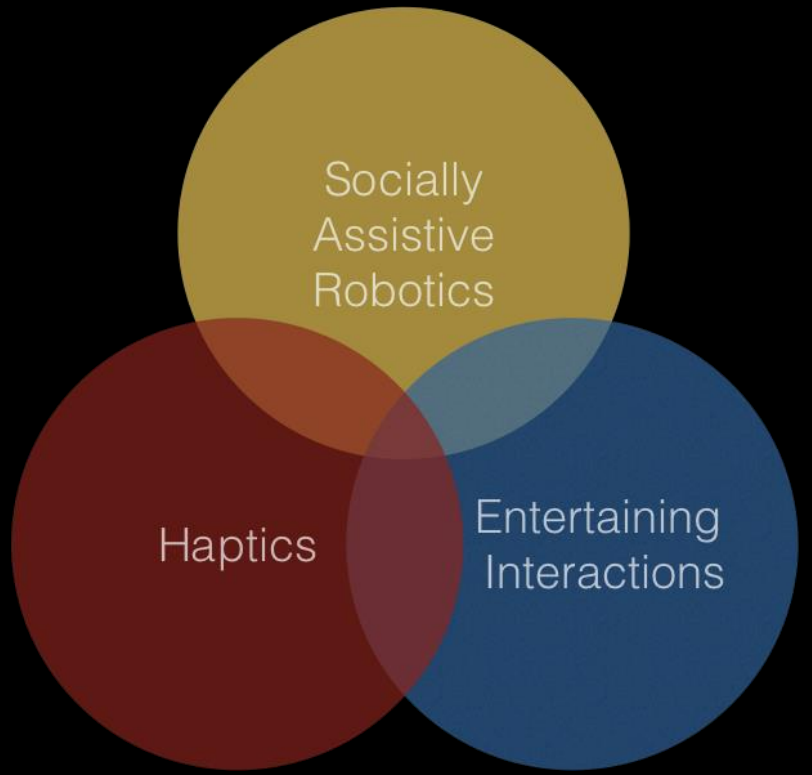
Create a thesis topic tangential to capstone project

– consider it as a side-project that is an independent study

– Opportunity to delve deeper into a part of the project that you are passionate about

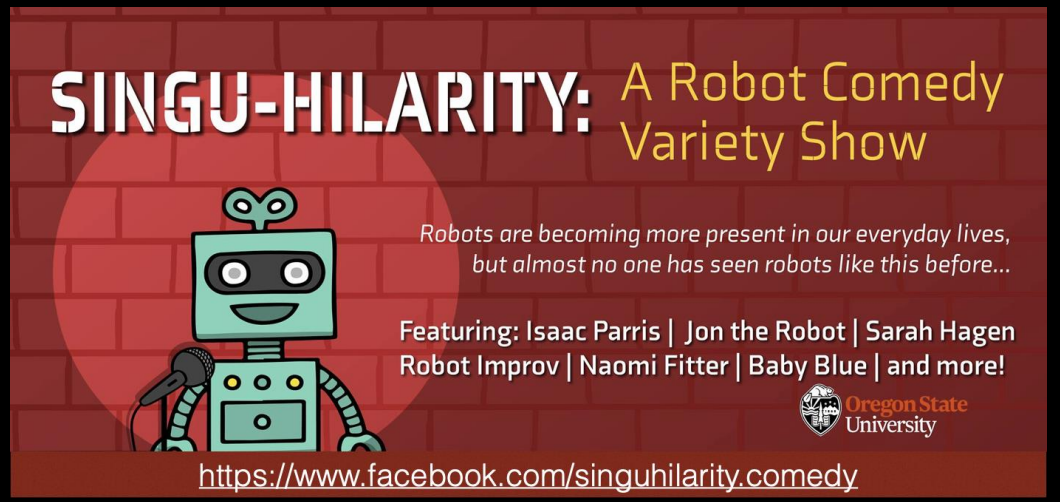


Naomi T. Fitter, Ph.D.
Assistant Professor of Robotics
Oregon State University



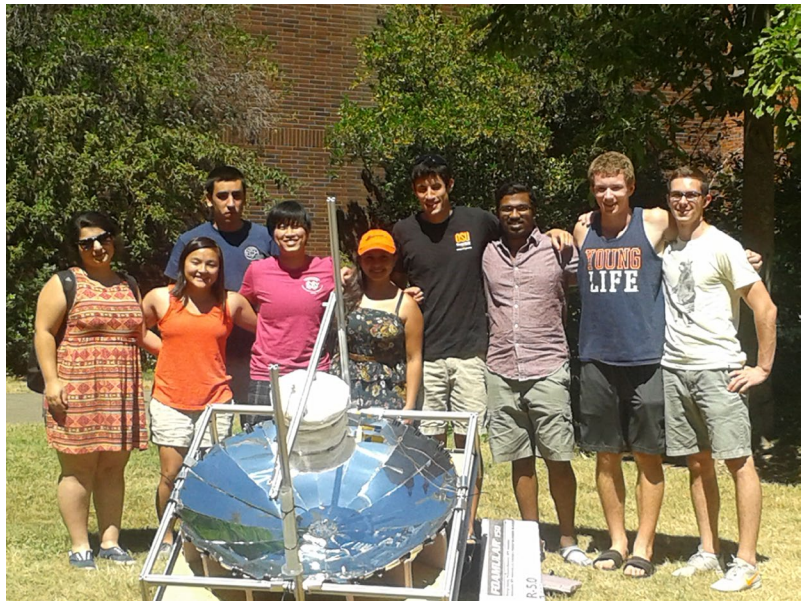
SHARE Lab

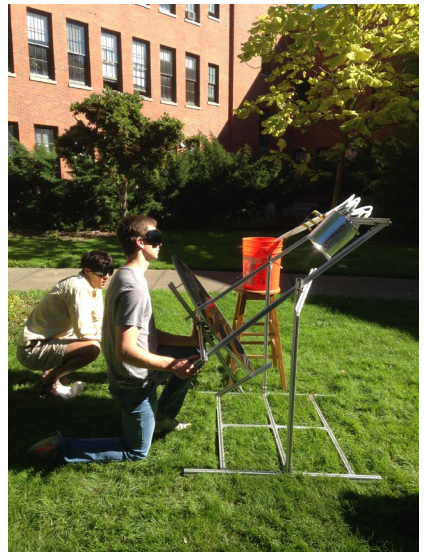
https://osusharelab.com/



Nick AuYeung, School of Chemical, Biological, and Environmental Engineering

Sustainability, Decarbonization, Energy Efficiency





- ***Storage of heat using reversible chemical reactions***
- ***Solar-driven fuel/chemical production***

Current Work and Potential Topics

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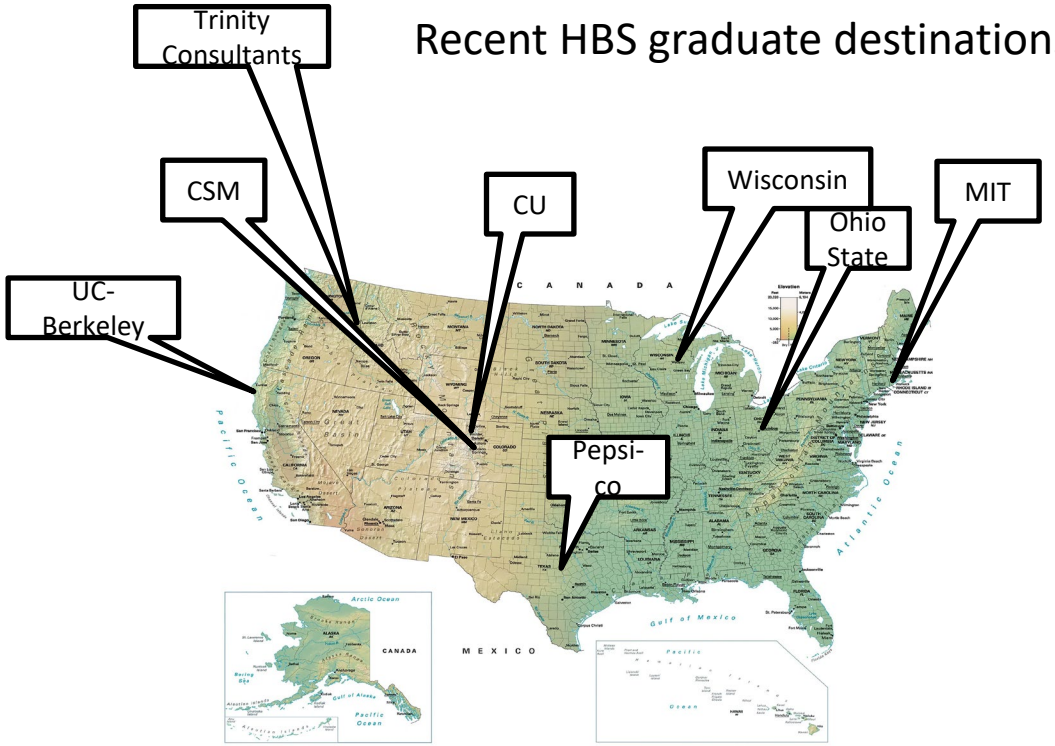
College of Engineering

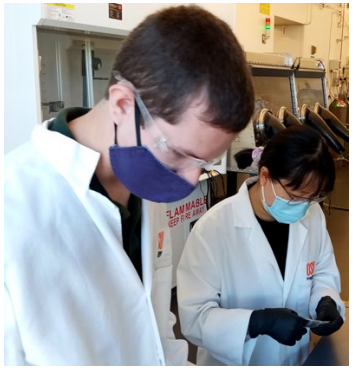
- Thermal/thermochemical storage
  - High temp HX-reactors
  - Waste heat recovery
  - Thermochemical cookstoves
  - Low temp thermal storage

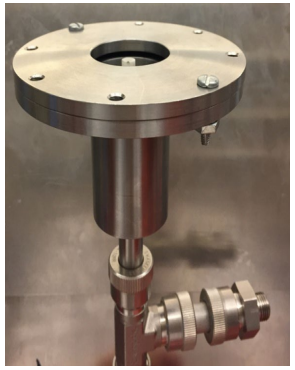
- Solar displacement of fossil fuels
  - Renewable process heating for industry
  - Alternative fuels (e.g. H_2)

- Open to your interests!
- nick.auyeung@oregonstate.edu

Recent HBS graduate destinations







College of Engineering and HC Thesis Mixer

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College of Engineering

Teaching

CHE311, Thermodynamics (~100 students)

CHE444/544: Thin Film Materials Processing (40 students)

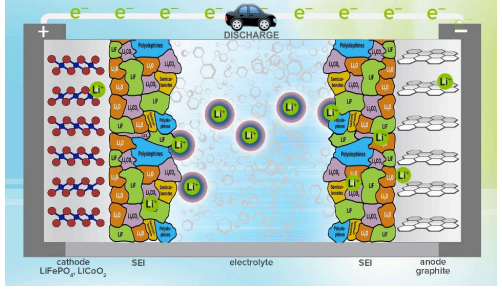
CHE452/552: Electrochemical Energy System (~20 students)

Zhenxing Feng

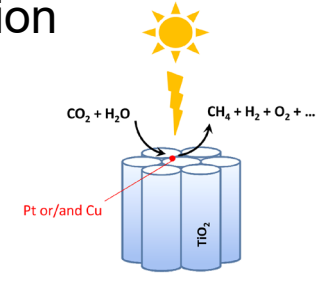
Associate Professor
School of Chemical, Biological, and Environmental Engineering
Johnson 216D
541-737-0508
zhenxing.feng@oregonstate.edu

Research

Energy storage: lithium/sodium batteries

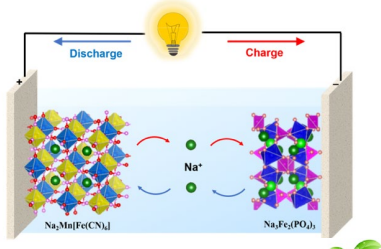


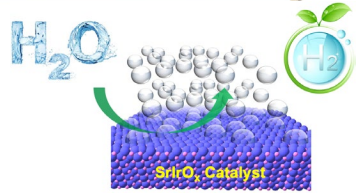
Energy conversion: fuel cell, water splitting, CO_2 reduction



Thesis Topic Ideas/Opportunities

1. Lithium-ion battery recycling
2. Cost-effective electrocatalysts for green hydrogen generation.





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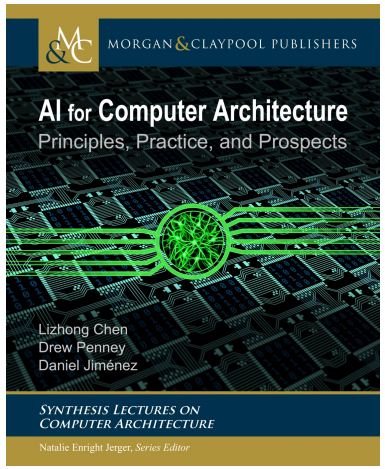
Teaching



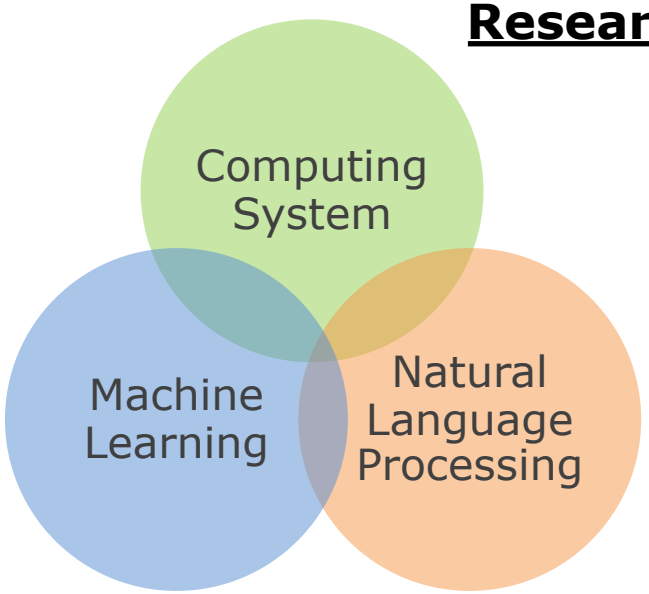
- Computer Architecture
- GPU Architecture
- Machine Learning Accelerator
- High-Performance Computing

Lizhong Chen

School of Electrical Engineering and Computer Science

Kelley 3113
541-737-3317
chenliz@oregonstate.edu

Research



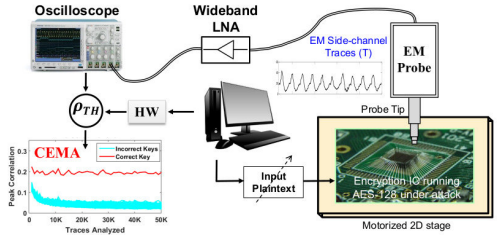
Supported by:

NSF · U.S. DEPARTMENT OF ENERGY · intel · NVIDIA · NIH · Google · XILINX

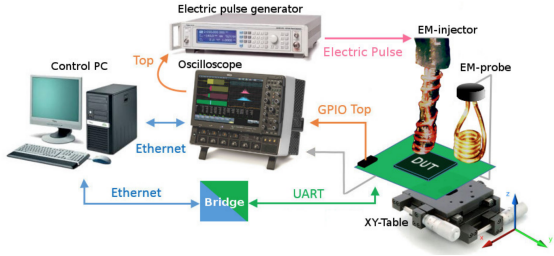
Thesis Topics/Opportunities

- Machine learning accelerators
- AI for computer systems
- ML applications (LLM/Generative AI)
- Data centers and HPC systems
- GPU architectures
- Mobile, wearable and IoT devices (VR/AR, etc.)

Physical Security



(source: "STELLAR: A Generic EM Side-Channel Attack […]")

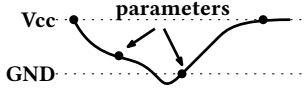


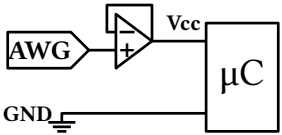
(source: "Studying EM Pulse Effects on Superscalar Microarchitectures at ISA Level")

- Non-invasive Attacks
  - Eavesdrop signals from crypto hardware
  - Massive data analysis + AI ('big data')
  - Statistics that make you happy
- Fully-Invasive Attacks
  - Focused Ion Beam → 'chip-edit'
  - Scanning Electron Microscope → 'chip-RE'

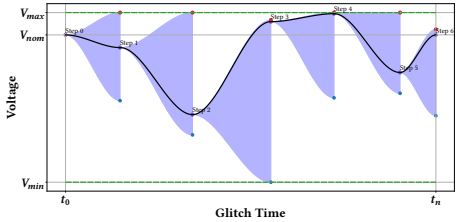
- Semi-invasive Attacks
  - Fault injection: change data/control flow
  - Voltage, clock glitches; lasers
  - High voltage/short rise EM pulses
- Anti-Tamper Enclosures
  - Physical 'Access Denial System'
  - Highest security, e.g., for banking

Possible Research Topics





- ECE Related
  - Building a high-driving circuit for VFI
  - Custom electromagnetic probe
  - Tamper-resistant systems



- CS Related
  - Custom toolchains for analysis
  - Automated attack scripts
- AI Related
  - Using RL to generate VFI waveforms
  - ML enhanced attacks and data analysis

Contact: salageda@oregonstate.edu vincent.immler@oregonstate.edu rootoftrust.io

Applied Network Security Research

Oregon State University
College of Engineering

Zane Ma
Assistant Professor
Computer Science

https://zanema.com
zane.ma@<school>

Research Questions

How can we securely identify web browsers, web sites, and users on the internet?

How can we use large-scale measurement and data mining techniques to make security more scientific, and ultimately, more robust?

Does 5G technology cause respiratory illness? Is it a vector for mind control?

Web Server Authentication

Identifier Usability + Abuse

Emerging Technologies

Thesis Topic Ideas

Mapping the internet using natural language processing (NLP)

Beating robo-callers (phone spam) at their own game

Breaking the software that creates nearly all HTTPS certificates

Security analysis of any interesting device (e.g., robot vacuum, continuous glucose monitor)

For more, take a look at:
https://empirical-security.net/projects

Next year, look for CS499/579: Empirical Computer Security!

COE Research Showcase

Oregon State University
College of Engineering

Huazheng Wang

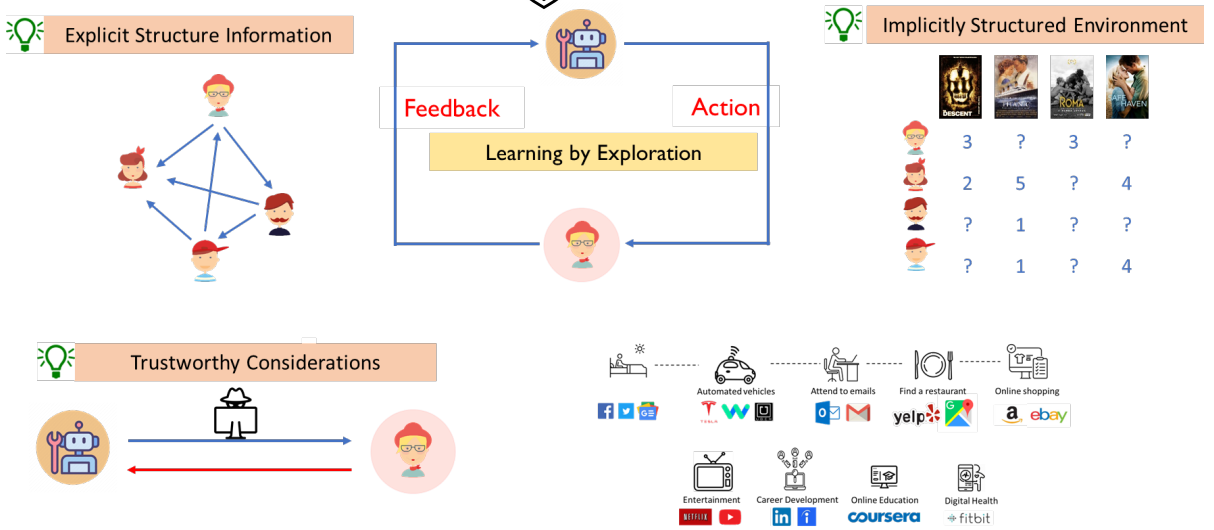
Assistant Professor of Computer Science

huazheng.wang@oregonstate.edu

https://huazhengwang.github.io/

Teaching

- Information Retrieval
- Online Learning



Research

- **Information Retrieval:** recommender system, web search and ranking, large language models (LLM)
- **Reinforcement Learning:** active exploration under uncertainty with explicit or implicit structure information
- **Trustworthy** decision-making – robustness, fairness,

Thesis Topics and Opportunities

- LLM for recommendation and ranking: pairwise and listwise prompt optimization
- Offline Reinforcement Learning: theory and algorithm for learning to rank
- Robust Reinforcement Learning from Human Feedback (RLHF) to finetune LLM

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College of Engineering

ML QuESt Lab

https://hutchinson-lab.github.io/

We are a team of scholars developing and applying machine learning methodology in service of ecology and conservation.

We are currently 6 graduate students and 1 undergraduate.

Rebecca A. Hutchinson

School of EECS / Dept. of Fisheries, Wildlife, & Conservation Sciences

Kelley 2071

rah@oregonstate.edu

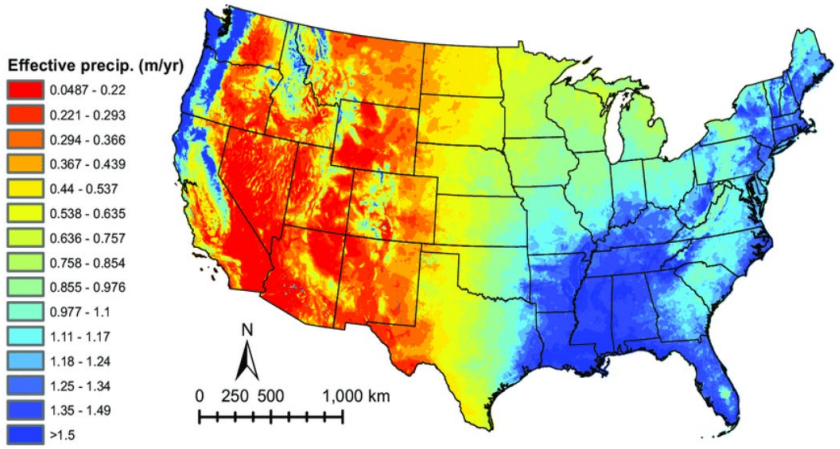
Research

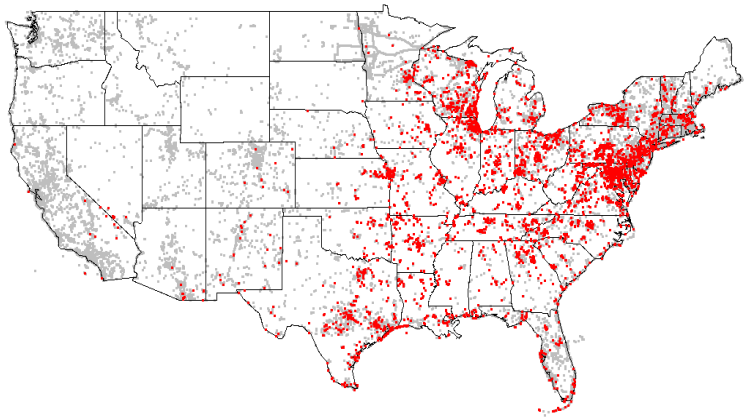
Our research is at the intersection of machine learning and ecology.

We are part of the computational sustainability community, trying to find ways that computer science can contribute to promoting the health of the Earth's ecosystems and bringing interesting new problems back to computer science.

Thesis Topic Ideas/Opportunities

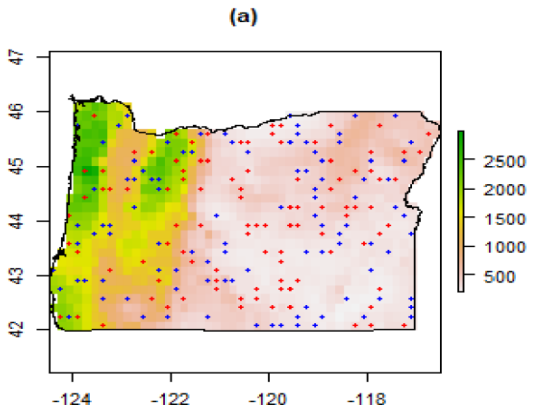
- ***How to evaluate SDM quality for different kinds of conservation applications***
- ***How to expand our model evaluation work to spatial-temporal problems that will have applications under climate change***



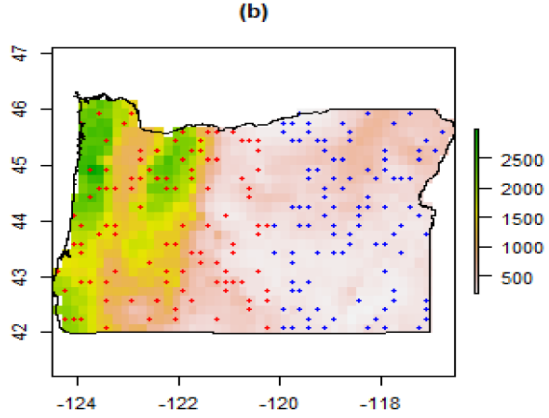


Research Question:

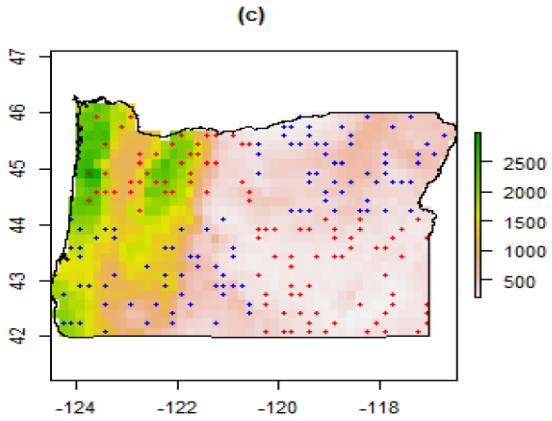
How to split spatial data to achieve unbiased prediction error in model evaluation?



High spatial autocorrelation
Low extrapolation



Low spatial autocorrelation
High extrapolation



Low spatial autocorrelation
Low extrapolation

https://www.researchgate.net/figure/The-Effective-Mean-Annual-Precipitation-across-the-United-States-for-the-2000-2013-Time_fig1_318509199

College of Engineering and HC Thesis Mixer

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College of Engineering

Software Engineering Education, Analytics and Assessment Lab (*SEAL*)

- Investigating collaborative software engineering through log data
- Designing pedagogies and technology tools for formative and summative assessment

Chris Hundhausen
chris.hundhausen@oregonstate.edu
Associate Head for Online Education
Director, CREEdO
Professor
EECS

Ahsun Tariq
tariqa@oregonstate.edu
Ph.D Student | GRA
EECS

Brian Mulanda
mulandab@oregonstate.edu
Ph.D Student |GRA
EECS

Istiak Shihab
shihabm@oregonstate.edu
Ph.D Student |GTA
EECS

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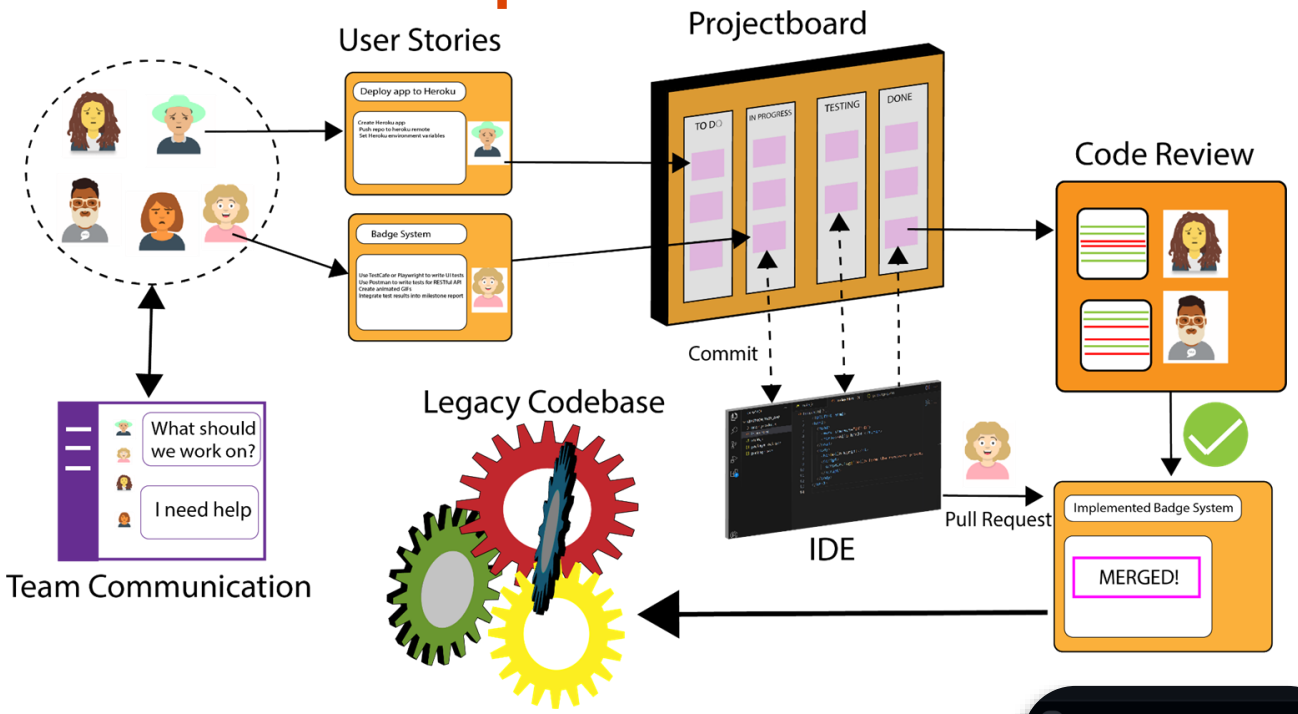
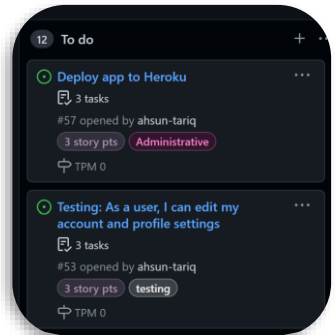
- How do AI assistants e.g GitHub Co-pilot and Chat-GPT affect code quality and developer productivity?
- How do programmers interact with legacy code systems?
- What practices and artifacts impact software development processes and software products?
- What metrics can we use to assess software development team projects and provide formative feedback?
- What themes can we identify from developers' communication e.g contribution, planning, reflection? How do they affect team projects?

Collaborative Software Development Artifacts

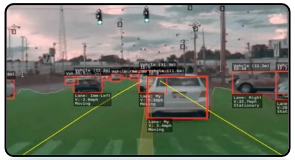


- **Code Repositories**
  - *Commits*
  - *Issue Tracking*
  - *Pull-Requests*
  - *Project Board*
- **Developer Operations**
  - *Team Communication*
  - *Peer Evaluation*
  - *Reflection and Retrospective*

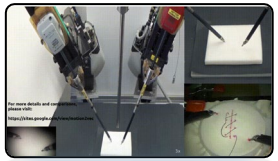


RESEARCH ON SECURE-AI SYSTEMS LAB (SAIL)

AI IS AMAZING, BUT IT FAILS...



AUTONOMOUS CARS

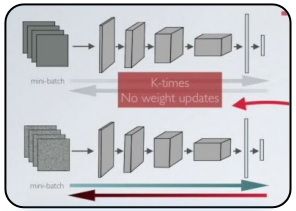


ROBOT SURGERY

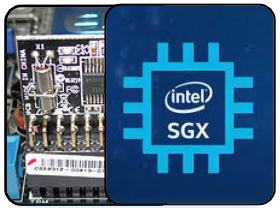
UBER'S AI CAR FAILS

ADVERSARIAL INPUT

PEOPLE WORK ON MAKING IT SECURE



SECURE LEARNING



SECURE HW, SYSTEMS

WOULD IT LEAD TO SECURE AI WORLD? NO

THESIS TOPICS AND OPPORTUNITIES

Breaking deep learning models
Breaking existing defenses against attacks
Understanding why attacks are possible
Develop a better defense mechanism

...

or you can propose your own idea(s)

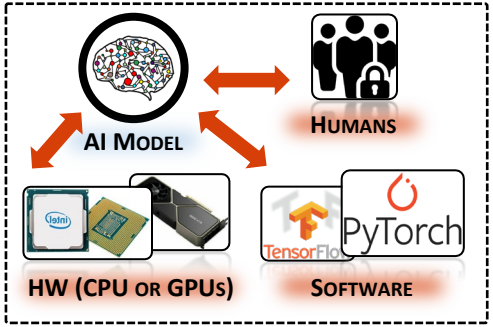
CONTACT ME:

NSF
Google Brain
SAMSUNG ADVANCED INSTITUTE OF TECHNOLOGY

Sanghyun Hong
Assistant Professor
School of Computer Science

sanghyun-hong.com
sanghyun.hong@oregonstate.edu

RESEARCH: BUILDING SECURE AI FROM A HOLISTIC VIEW



Unique Perspective: AI is not a mathematical concept, but also ***a computational tool*** running on h/w and s/w

My work focuses on:
- New security/privacy attacks on ML
- Understand ML's internals
- Develop defense mechanisms

Ian Arndt & Xavier Quintana
Briggs Lab
Nuclear Engineering
Box File

SCIENTIFIC AMERICAN

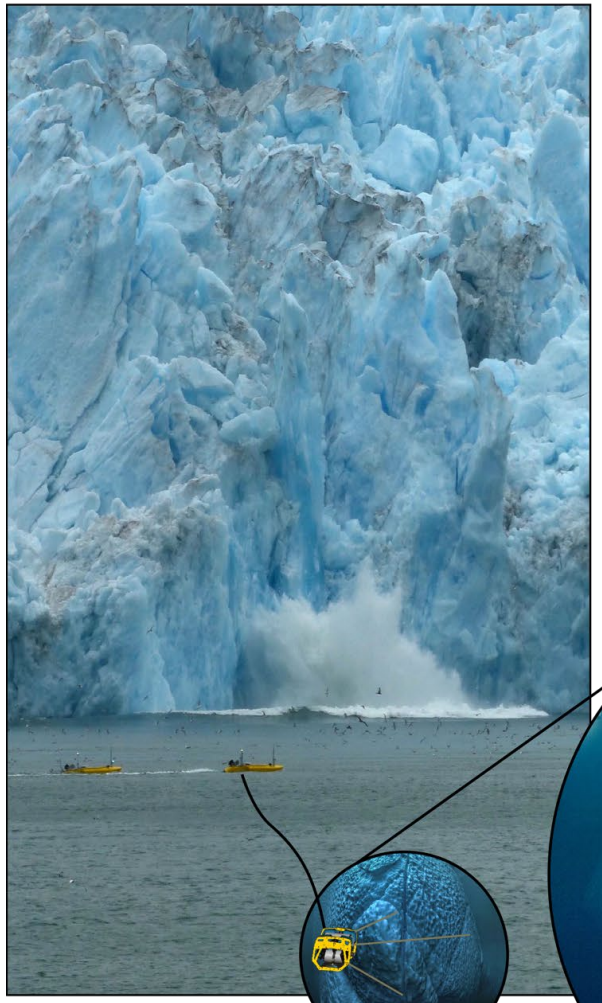
Many opportunities in ocean and climate science for students to develop robots, sensor systems & code and gain experience in challenging environments

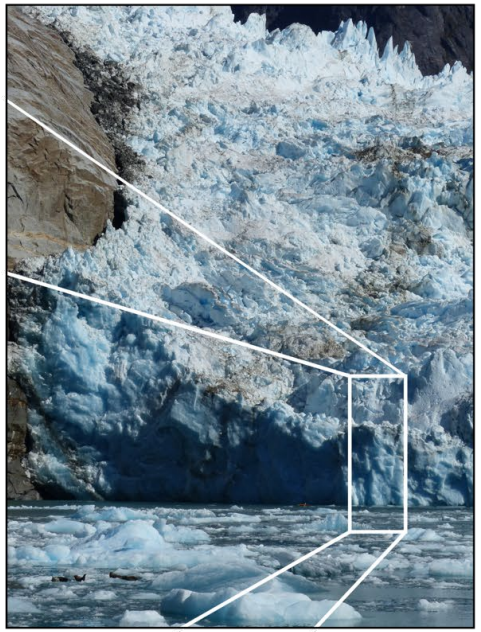
Jonathan.Nash@oregonstate.edu

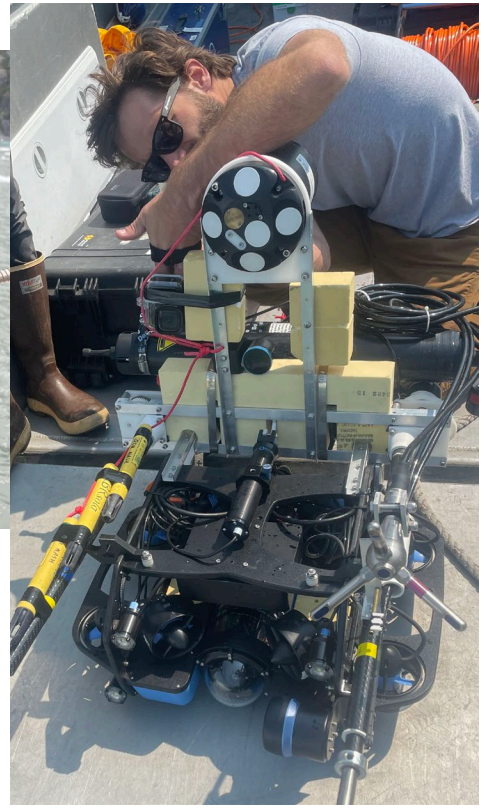
MELTDOWN

Jonathan.Nash@oregonstate.edu

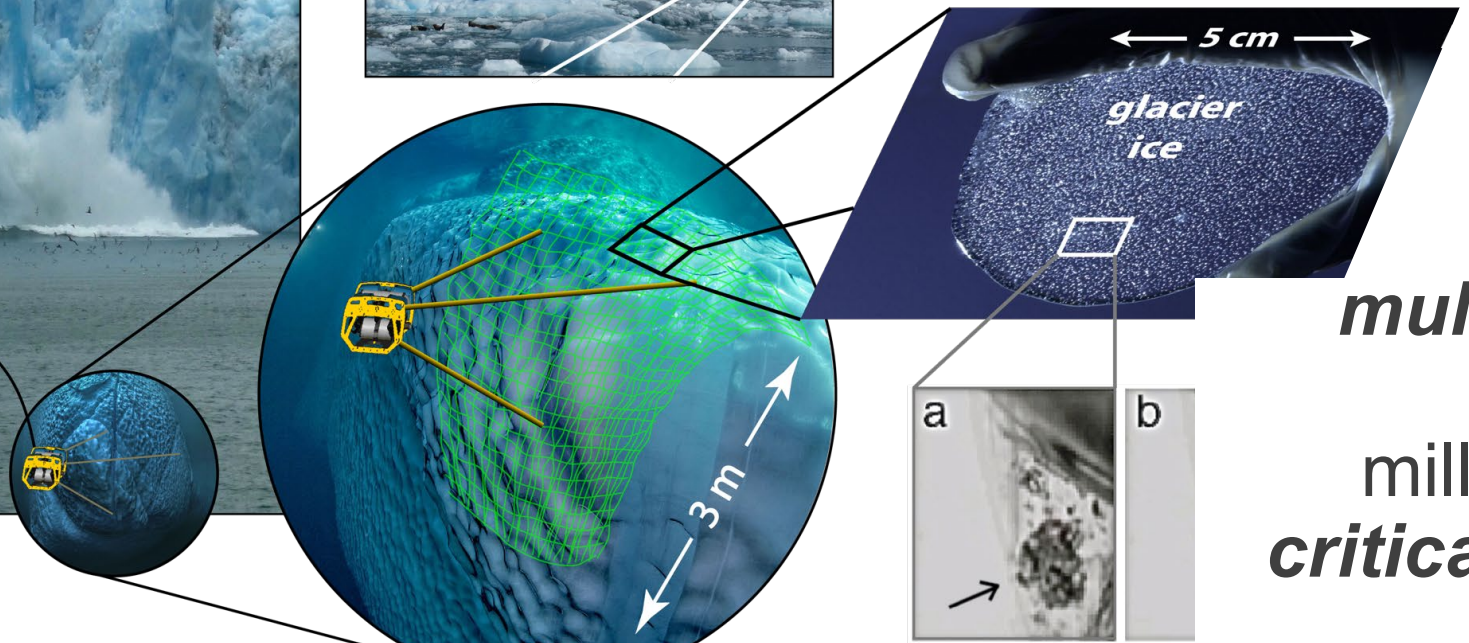
Robotics & Sensors for Ocean Applications







College of Earth, Ocean & Atmospheric Science (CEOAS)



experience
real-world challenges
connecting
multiple robotic systems
to sample large &
millimeter-scale dynamics
critical for climate prediction

College of Engineering and HC Thesis Mixer

Oregon State University
College of Engineering

Tom Osborn Popp

Department of Chemistry

LPSC 253
541-737-7730
osbornpt@oregonstate.edu

Teaching

Fall 2023: CH464 Experimental Chemistry II

Spring 2024: CH233H General Chemistry

Research

- **Development of novel devices for solid state nuclear magnetic resonance spectroscopy**
- **Application of these technologies to reveal new insights about complex material and biomolecular systems**

Research Website

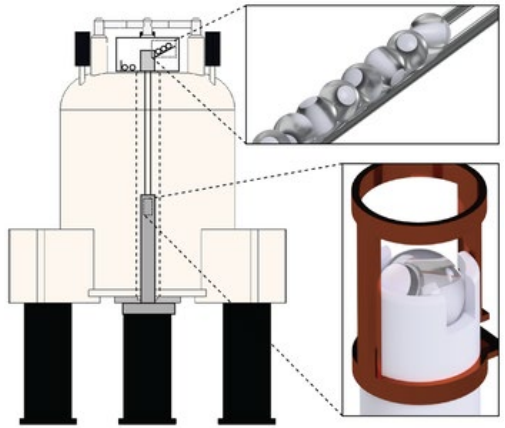
osbornpopplab.com

Thesis Opportunities

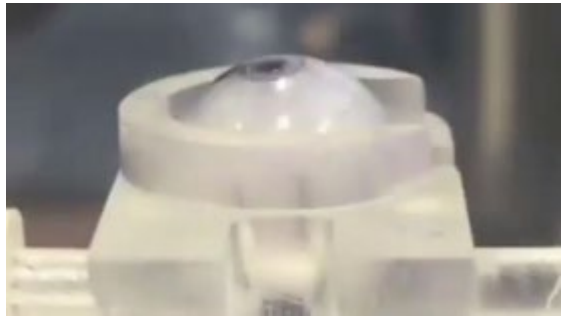
Looking for creative and motivated students to join the lab and participate in cutting-edge NMR research. Ideally either familiar with CAD or eager to learn.

We use stereolithography (SLA) resin 3D printing and other fabrication techniques to develop new devices for NMR spectroscopy, including pneumatically-driven spinning devices for solid state NMR.

Projects at the interface of physics, chemistry, mechanical, electrical, and chemical engineering



Below: a spherical rotor in a 3D-printed stator spinning up to 4 kHz



College of Engineering and HC Thesis Mixer

Oregon State University
College of Engineering

Teaching

- ME373/ME373H (Honors section of Mechanical Engineering Methods)
- ME331 (Fluid Mechanics)

Sourabh V. Apte

School of MIME, Rogers 308

sourabh.apte@oregonstate.edu

Past UHC Theses @

http://web.engr.oregonstate.edu/~sva/theses.html

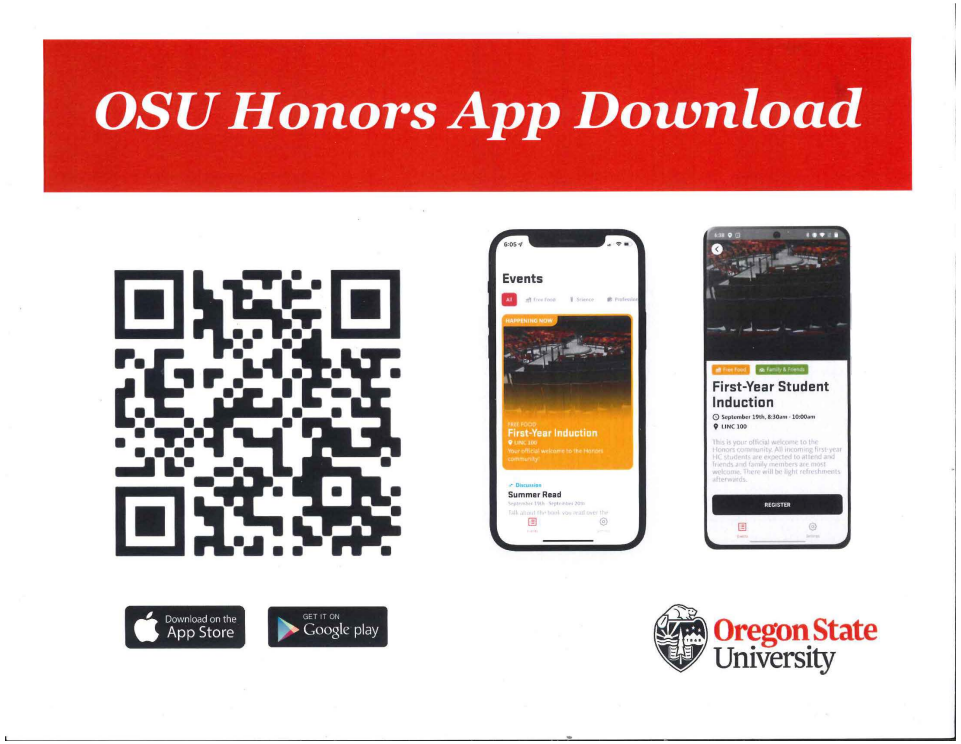
Research

- My group works on development and application of numerical algorithms for predictive simulations of complex flows.
- UHC theses involve developing models (in Matlab/Python), and/or using in-house research solvers to study turbulent flows using parallel computing.

Thesis Topic Ideas/Opportunities

- Modeling motion of non-spherical particles in a turbulent flow (sprays and liquid ligament breakup in combustion chambers)--- Honeywell, Inc
- Thermal-fluid modeling of rarefied gases in semiconductor devices during chemical vapor deposition -- Lam Research
- Modeling turbulent flow over rough surfaces (drag reduction, porous media, sediment transport) –DoE/NSF

Stay informed about Honors College Events and Opportunities!
Download the Honors College Community Connector app



The next Faculty Research Showcase will feature the Colleges of Science, Vet Med, and Pharmacy on Tuesday November 14, 4:00 pm in LINC 100.