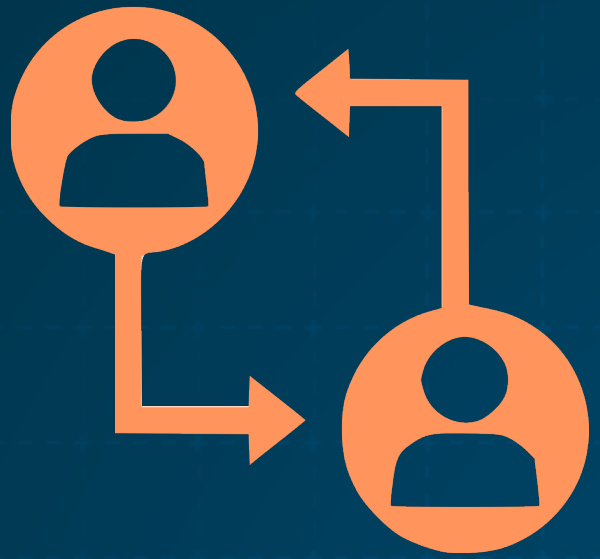
CINT Research Initiative Program Info Session

SAND2022-0476 PE

What is this program?

Scientific collaborations



Nanoscience

CINT users

Characteristics:

- Open to undergrad. AND grad. students
- Cost-share: Sandia match funds committed by university (~20k/student)
- Students come in as CINT users

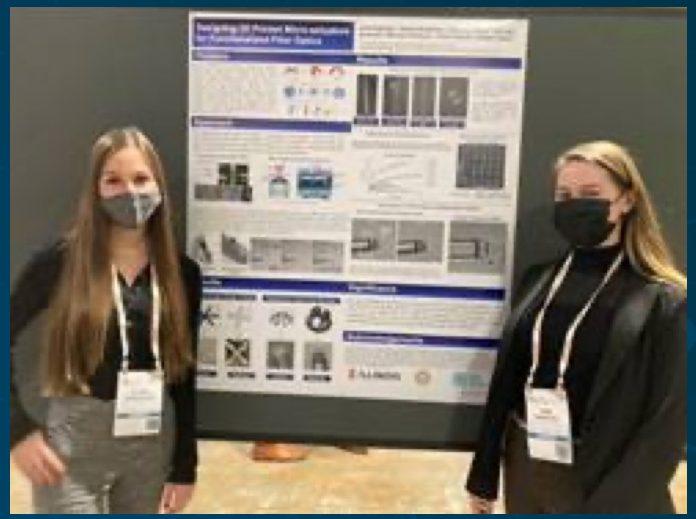
2021 cohort

Student	Topic	University	Mentors
Ellen Park	Cryo-EM of structures of soft materials	GT	John Watt (CINT) Prof. Jennifer Curtis (GT)
Aminur Chowdhury	Gold plasmonic islands @ TiO2 for photocatalytic degradation of VOCs	UT Austin	Willie Luk (CINT) Prof. Tanya Hutter (UT Austin)
Timothy Davis	Nanoscale mechanical and structural characterization of nanometric coatings on polymer battery separators	TAMU	Brad Boyce, Katie Jungjohann (CINT) Prof. George Pharr (TAMU)
Aulden Jones	Design and implementation of bulk ESR capability	GT	Mike Lily, Andy Mounce (CINT) Prof. Martin Mourigal (GT)
Adia Radecka	Printed sensing and control in soft robotic actuators - Part I	UIUC	Bryan Kaehr (CINT) Holly Golecki (UIUC)
Alyssa Bradshaw	Printed sensing and control in soft robotic actuators - Part II	UIUC	Bryan Kaehr (CINT) Holly Golecki (UIUC)
Thomas Marchese	Investigation of lithium metal creep rate size effect by constant load indentation	GT	Katie Jungjohann (CINT) Prof. Matthew McDowell (GT)
Justin Gruber	Machine learning and analysis of microstructural evolution of porosity in geopolymer composites	UIUC	Remi Dingreville (CINT) Prof. Waltraud Kriven (UIUC)
Matthew Kuner	Automatic HRTEM image segmentation	GT	Brad Boyce (CINT) Prof. Aaron Stebner (GT)
Nicole Person	Vanadium dioxide device fabrication, irradiation, and the effects on electrical properties	TAMU	Tzu-Ming Lu (CINT) Prof. Patrick Shamberger (TAMU)
Eva Natinsky	Signal reconstruction of sparse, nano-scale metrology data using Noise2Noise	UT Austin	Remi Dingreville (CINT) Prof. Michael Cullinan (UT Austin)

Examples of success stories

- **New collaborations:** A Jones (UG GT) / M Mourigal (Physics GT) / M Lily (CINT) have an on-going collaboration on QIS that started in the summer of 2021.

- **Promoting nanoscience:** Illinois students took their research related to nanoscale fabrication techniques to Boston
  A Radecka (UG UIUC) / A Bradshaw (UG UIUC)
  H Golecki (Bioengineering UIUC)/ B Kaehr (CINT)



- **CINT users:** E Natinski (G UT Austin)/M Cullinan (Mechanical Eng. UT Austin) new CINT users (Spring 2022) on using ML for nanoscale metrology for her PhD work

Components for success

SNL Academic Programs

ACADEMIC PROGRAMS
SR. MANAGER
DIANE PEEBLES

UNIVERSITY PARTNERSHIPS

NM PARTNERSHIPS
TRACIE DURBIN

UNIVERSITY OF ILLINOIS-URBANA-CHAMPAIGN
MATT WINDSOR
MALLORY STITES

PURDUE UNIVERSITY
KEN PATEL

UNIVERSITY OF TEXAS AT AUSTIN
NADINE MINER

GEORGIA INSTITUTE OF TECHNOLOGY
ANDRE CLAUDET

CINT User Program

University Partners

Georgia Tech

ILLINOIS

PURDUE UNIVERSITY

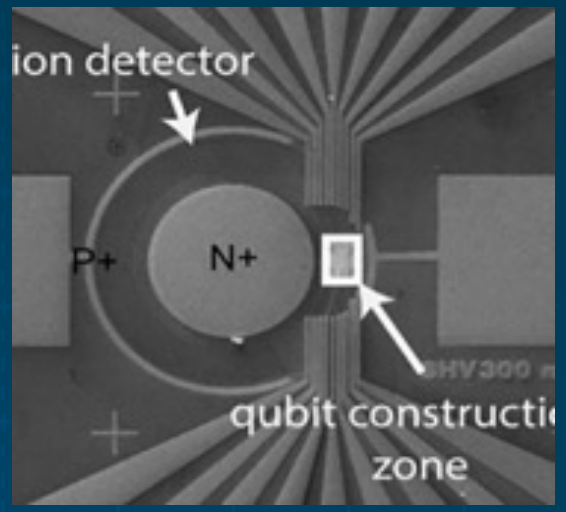
THE UNIVERSITY OF NEW MEXICO

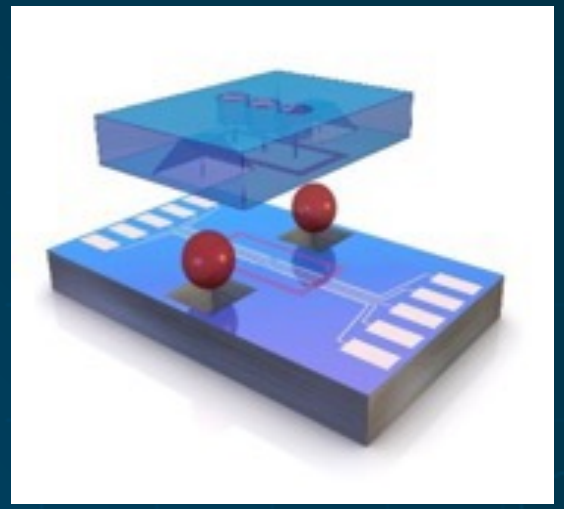
TEXAS
The University of Texas at Austin

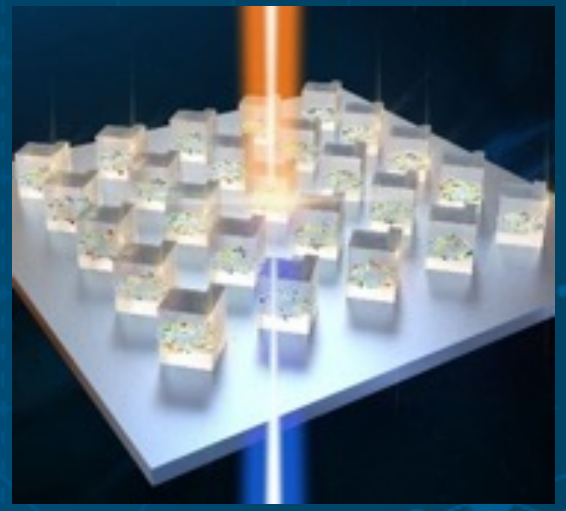
TEXAS A&M UNIVERSITY

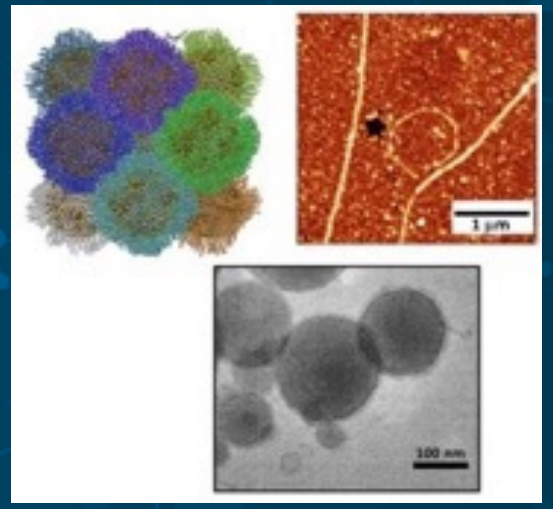
CINT – Science Thrusts

- *Quantum Materials Systems*
- *In-Situ Characterization and Nanomechanics*
- *Nanophotonics and Optical Nanomaterials*
- *Soft, Biological, and Composites Nanomaterials*









Major Nanoscience Challenges Targeted by CINT

CINT is invested in strengthening the following areas:

(1) Understanding the origins and controlling quantum phenomena in **quantum materials systems**

(2) Creating hybrid material interactions for the generation and manipulation of light particularly in the area of **meta-materials**

(3) **Soft Nanomaterials**: synthesis, assembly integration, characterization and theory

(4) **Nanomechanics** in extreme environments

(5) **AI/ML in nanoscience**

Examples of projects

Quantum Materials Systems

- Measuring and quantifying defects in 2D materials using electron spin resonance (T-M Lu)
- Performing device fabrication and electrical measurements on ion irradiated VOx devices for neuromorphic computing (T-M Lu)
- Quantum-sensed NMR for localized spin sensing (M Lily)

Soft/bio Nanomaterials

- Molecular dynamics simulations and analysis of self-healing highly branched polymers (A Frishknecht)
- Molecular electronic structure database for machine learning (M Stevens)
- Running gas adsorption experiments in zeolite and automating data acquisition with LabView programming (J Greathouse)

Examples of projects

Nanophotonics and optical nanomaterials

- Nano-antenna design (W Luk)
- Nanoscale infrared bolometers (T Harris)
- Modeling of topological photonics (A Cerjan)
- Superconducting electronic devices, for quantum information processing (T Harris)

In-situ nanomechanics

- Analysis of SEM and TEM data utilizing both conventional of AI/ML techniques (K Hattar)
- Development of new advanced in-situ SEM and TEM techniques for couples environments (K Hattar)
- Modeling of phase transformation in 2D materials (R Dingreville)
- AFM-based testing of 2D materials (F Delrio/R Dingreville)
- Development of a virtual TEM in COMSOL (K Hattar)
- ML for modeling microscopy data of energetic materials (R Knepper/M Hummel / R Dingreville)

What is next?

Student and project selection:

- **March 31:** Students selected by faculty and CINT scientist
- **April 30:** Submit rapid access CINT proposal involving student, CINT scientist, and faculty
- **June 6:** Student start at CINT. Coordinate between schools?

Logistics:

- We will help find/secure lodging
- Stipend/transportation/lodging handled by AA partners
- Duration: 8 weeks (6/6/2022 – 7/29/2022)

Contacts:

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University PIs