



**Harvard University:**  
*Center for **N**anoscale **S**ystems*  
**NSF NNCI Conference 2022**



Center for  
Nanoscale  
Systems  
Harvard University  
FAS • SEAS

# Epicenter for Interdisciplinary Nanoscience Research at Harvard: LABORATORY FOR INTEGRATED SCIENCE AND ENGINEERING (LISE)/ SEAS (SEC)



**Robert Westervelt**  
Director



**William L. Wilson**  
Executive Director

## *CNS Overview:*

- *CNS* serves as a one-stop shop for all things “Nano and Quantum” (almost fully self-use)
- *CNS* serves as an important regional, nanoscience community resource. (we are open access)
- *CNS* serves to support the primary innovation thrusts within the Harvard research community.
- *CNS* has initiated new training and educational programs to engage larger numbers of undergraduates, non-traditional, and underserved external users, in nanofabrication, advanced characterization and advanced imaging techniques.
- *CNS* is developing a number of new experimental platforms expanding our experimental capabilities; (example, Scanning probe spectroscopy platforms.)
- *CNS* is engaged with proposal development, Research Centers Development, Equipment acquisitions, etc.
- *CNS* now offering additional support for new Start-up companies and is establishing alliances with local incubators technology.

# Overview: CNS Infrastructure and Mission

## Our Mission

To evolve and nurture research communities in advanced processing technologies enabling transformative device research.

### Nanofabrication

- Component driven
- Complete lithography
- Non-traditional materials/Met
- Multiple length



FOR INTEGRATED  
ENGINEERING  
CASE):

Year 7: Web of Science (1541959/2025158)  
158 Publications / 4 Highly cited  
6 Early Access

- Vasc
- Mechanical properties of single cells
- Field synthesis for universal light sheets
- In vivo RNA editing
- Review on profiling RNA-protein interactions

y Lab  
roscopy Lab

# CNS Userbase Research Focus

## QUANTUM SCIENCE & ENGINEERING:

QUANTUM INFORMATION SCIENCE-SYSTEMS AND DEVICES

NANOOPTICS, NANOPHOTONIC DEVICES, NANOSPECTROSCOPY

## QUANTITATIVE BIOLOGY:

NANOMECHANICS; NANOSCALE STRUCTURAL ANALYSIS

## BIOENGINEERING:

TRANSLATIONAL BIOSCIENCE

ADVANCED IMAGING (CRYOEM)

Exploring avenues to better support "Advanced" process development for Quantum Materials/Devices  
- Supporting New *Harvard Quantum Initiative*

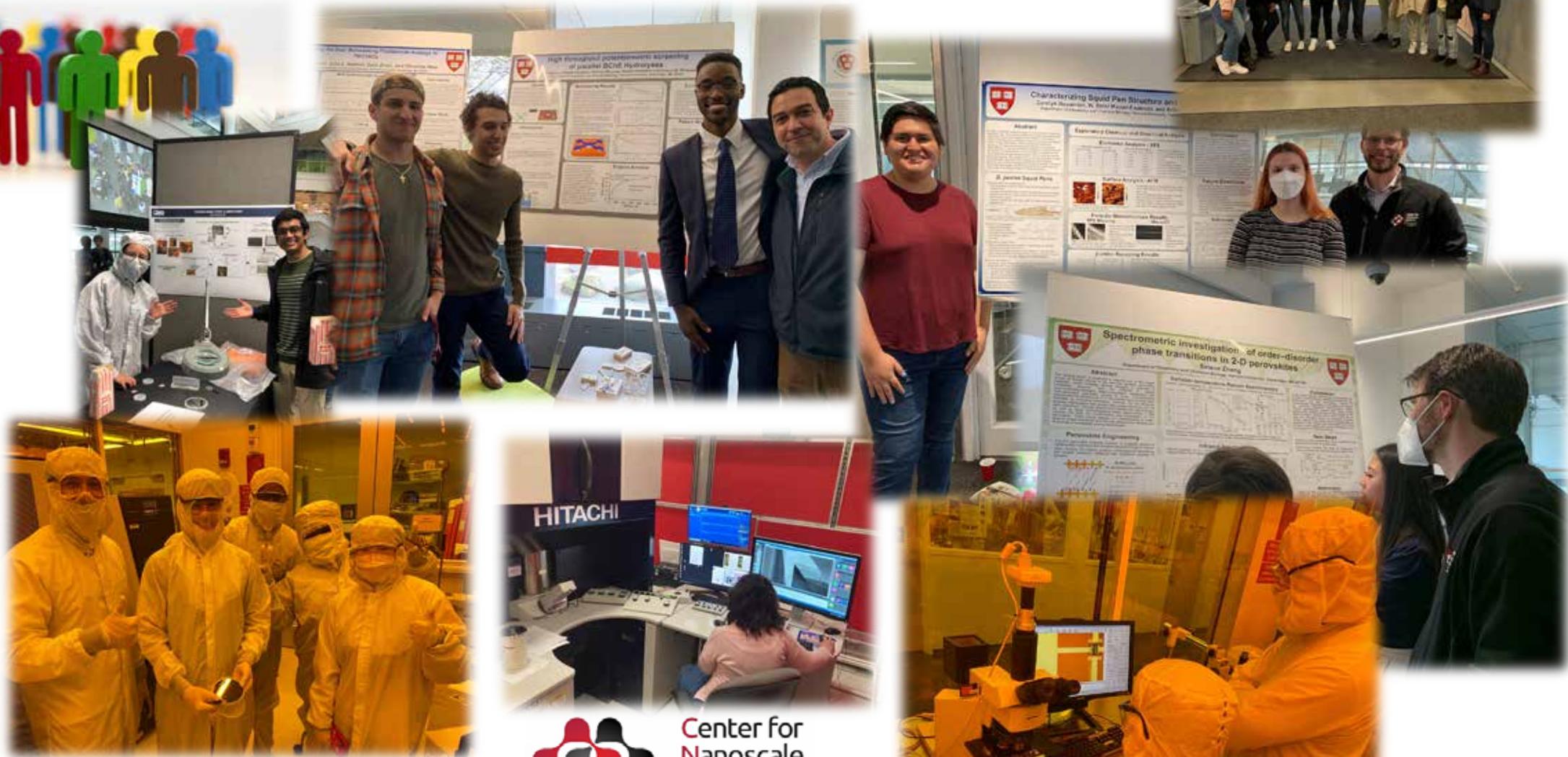


Quantum Information Science and Technology

# Undergraduate Engagement (*Direct Class Support*)



ES 100  
ES 177/277  
ES 176/276  
ES 293  
BE 128  
Chem 165  
MCB 68  
AP 218  
AP 291



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# Workforce Development (*Direct Class Support*)

- Class support in CR is new for us
- Assumption, conflict between Research & Teaching
- It's simply a question of usage capacity
- Need to explore and share best practices from other sites

Can we compile a white paper on what we all are doing???

# Harvard CNS: Education and Outreach

**REU** – conventional program : but with project offerings from entire userbase, both internal and external



**\*REU PROGRAM Includes**– Advanced research opportunities for UGrads from external, 2 and 4yr institutions;



**Research Experience Veterans** – *staff serves as mentors*  
(some interns carried through school year)

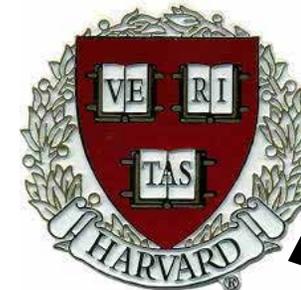
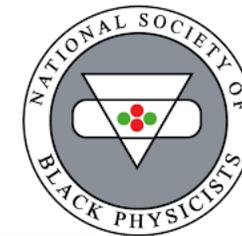
Fully Re-booted in 2022



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## Diversity Efforts: *Student Initiatives*

- Establishment of Student Chapter of NSBP at Harvard (now officially supported by Physics and the University)
- Sister Chapter being developed at MIT (plans for regional presence)



Iyabo Awogboro - Harvard  
Lanell Williams - Harvard

# Outreach - CNS Scholars (re-booting)



\*Prof. K. Dorsey – Smith College



Pheona Williams – MIT



Prof. R. Horton – Miss State University



Dr. Pia Sorenson – SEAS



Dr. Josh Burrow – Brown University



Prof. T. Brower-Thomas – Howard University



Prof. D. Simien – UAB



*Doing Check-ins/Spin-ups*

\*NSF Career Awardee



*\*(an attempt to finally develop a reoccurring condensed matter meeting similar to CAARMS)*

# meeting goals:

1. Creation of a Community building event for folks of Color (+) in Quantum/NanoScience and Engineering broadly cast.
2. To integrate and connect folks “*collaboratively*”, with leaders in the Quantum/Nano community in the Cambridge area. (*We may also consider a training component*)
3. Create an opportunity for Grad students and PostDoctoral researchers to get a full flavor of the frontiers of Quantum/NanoScience by exposing them to the leaders of relevant fields. There will also be an opportunity to connect HBCU students in the IBM HBCU Quantum Center with folks doing materials and device work (*a bit of recruiting for this space*)
4. Offering a Collaborative and Networking Opportunity for faculty and researchers of Color (+) in the Quantum/Nano Space.
5. Creating an opportunity for Junior Faculty to meet and Network with Federal Funders (NSF/DOE/DOD).
6. Creating an opportunity for Nano Researchers to meet and Network with Entrepreneurs and VC focused on this branch of science.

# Quantum Noir: Conference Scope:

“Gordon – Style” Nano/Quantum Science & Engineering Meeting: (2-1/2 Days / 2-year cycle)

- 30-40min talks (Some Expert tutorials – Summer School Like)
- Subject matter (Quantum Science / Nanoscience, broadly defined)
- Directed as students and researchers of color(+)

## tenative sessions:

- Quantum / Nano Materials (Ken Evans, BNL / Nadya Mason, UIUC / Jacob Gayles, USF / Trevor Rhone, RPI)
  - Quantum Information / Simulation (Charles Brown, Yale / Stephon Alexander, Brown)
  - Quantum Devices (systems / applications) (Deji Akinwande, UT / Bill Wilson, Harvard)
    - Ø Quantum Networking
    - Ø Quantum Logic
  - Quantum NanoPhotonics (systems / devices / applications). (Boubacar Kante, UC Berkley / Donell Walton, Corning)
  - Poster Session (Grad Student focused / student travel support provided)
  - Start-up landscape
  - Funding Agencies
- Banquet / Conference Dinner at Boston Museum of Science
    - Dinner speaker: NanoBio (systems / devices / applications)

# *Early logistics:*

- Preliminary Schedule (*planning for late June 2023*)
- To be held at the Harvard SEC / *Venue set*
- NSBP Supportive / (co-sponsor)
- Student travel support (*will be the focus of the fund raising*)
- Finishing an **NSF** Proposal to CMP
- Possible REU/Boot Camp tie-in

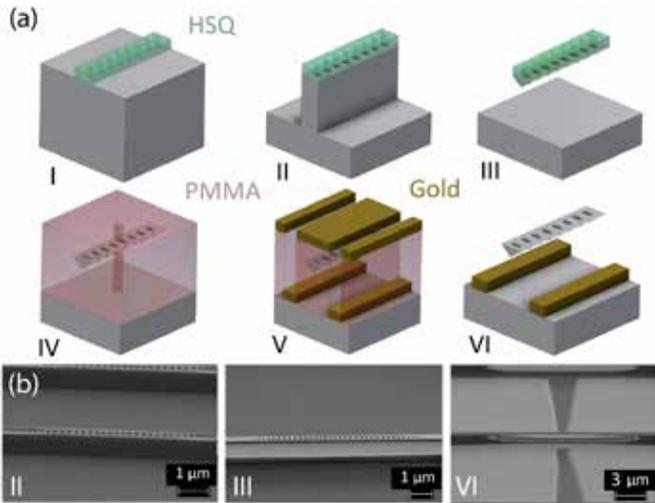
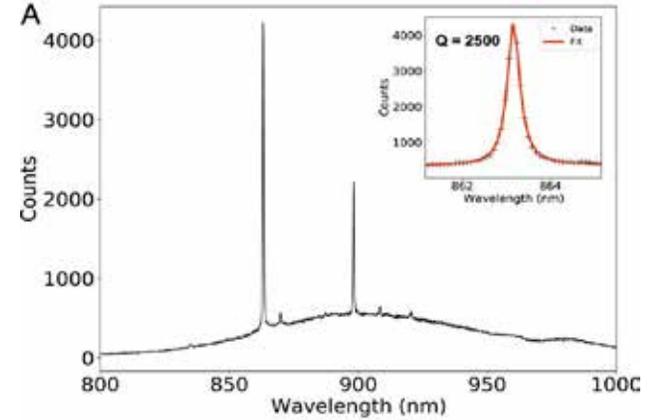
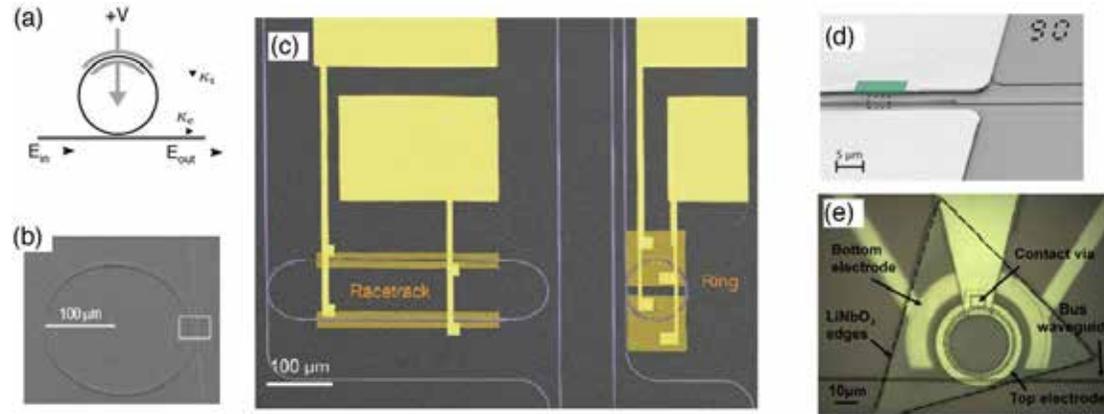
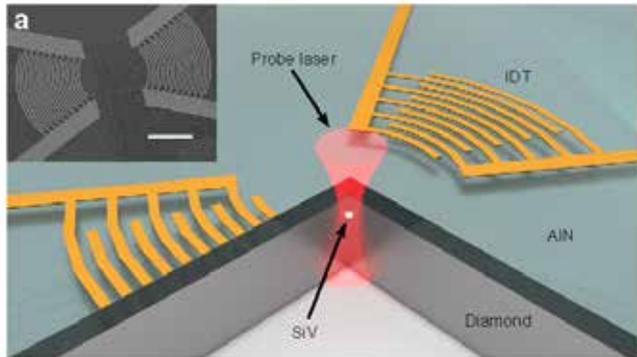
# Outreach: *Start-up Industry Support*



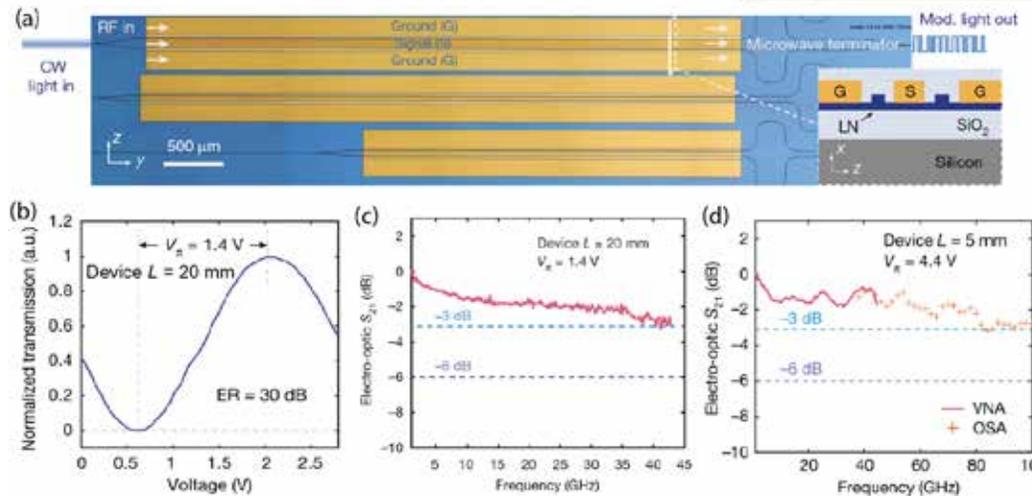
# BOLT

- Incubator engagement ongoing
- Start-up Bootcamp (returning Spring 2023)

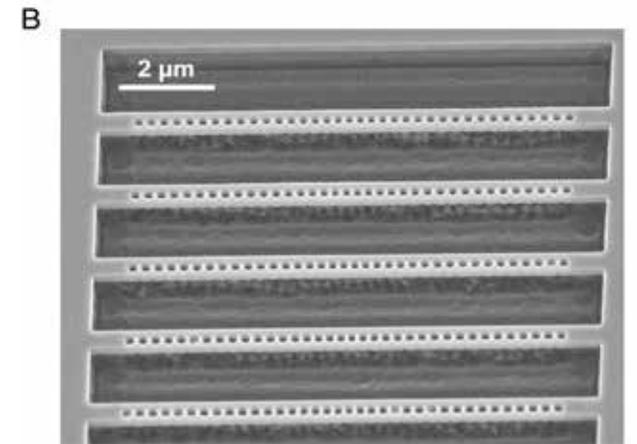
# Year 8 and Beyond: Quantum Infrastructure



Diamond

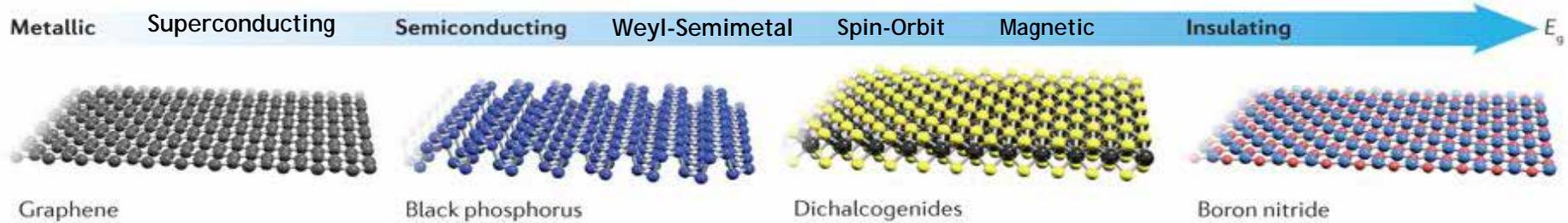


LiNbO<sub>3</sub>



SiC: VSi

# Fund Re-purposing: *Quantum Infrastructure*



Exploring how to *enable* infrastructure development



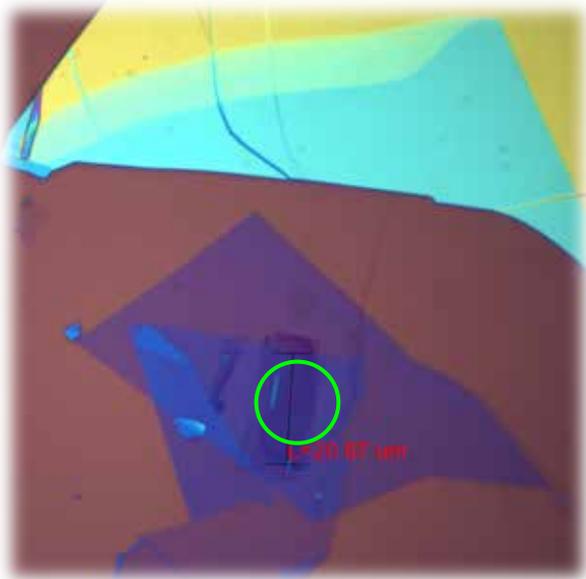
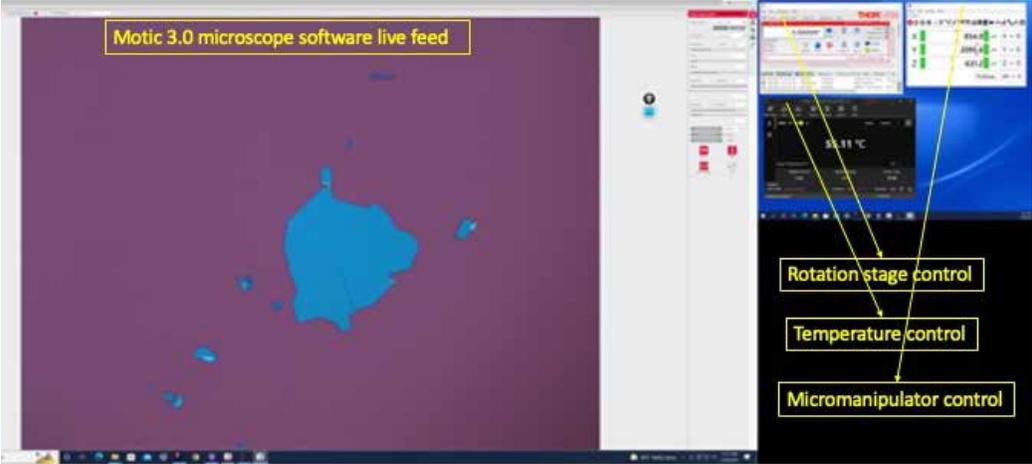
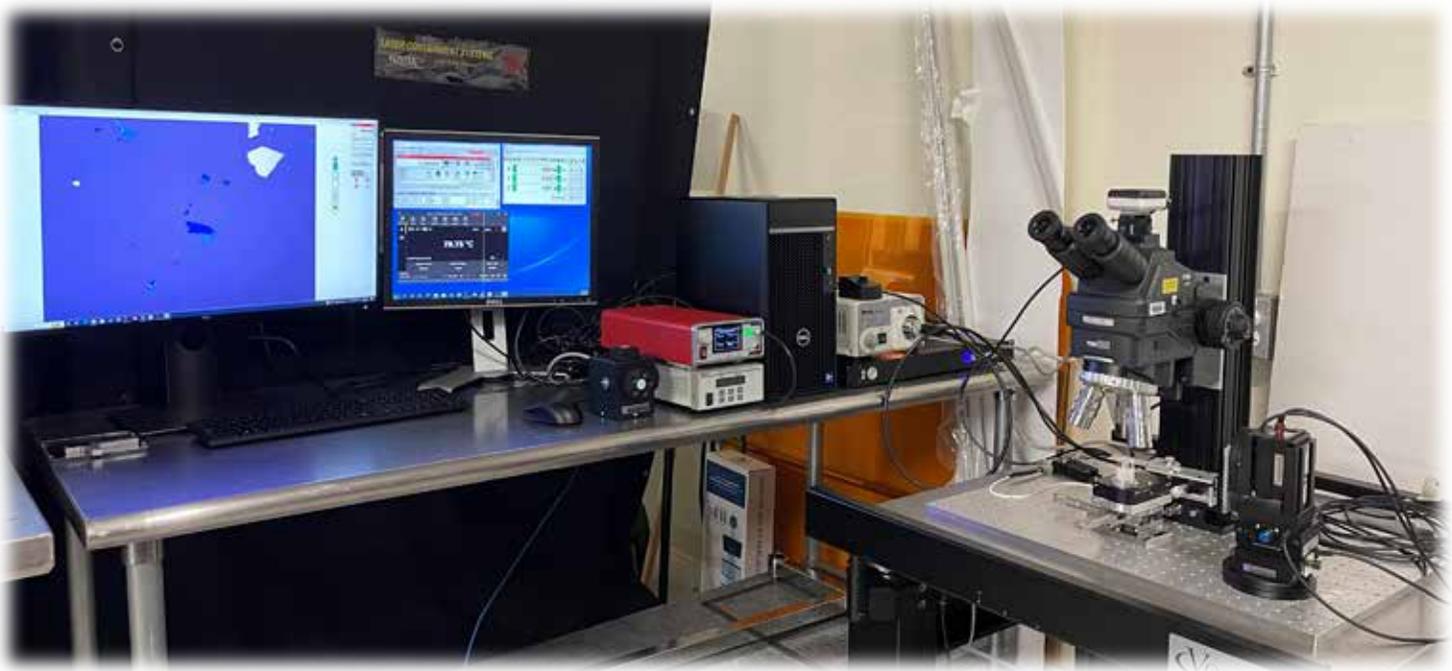
Using NNCI Support  
To build out of 2D Assembly  
System for our userbase:  
(Hired Engineering Masters  
Student Intern to support  
construction)



Danial Heai - UMass

# Fund Re-purposing: *Quantum Infrastructure*

## Software and interfaces







Thank you!  
Questions?  
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<https://cns1.rc.fas.harvard.edu/>

