


ARKANSAS

# First Annual Workshop
# NSF ExpandQISE

**NSF Expanding Capacity in Quantum Information Science and Engineering**

**January 16-18, 2025**

UNIVERSITY *of* ARKANSAS AT PINE BLUFF™

**First Annual Workshop**
**NSF Expanding Quantum Information Science and Engineering**

Date (s): Jan 16th to 18th, 2025. Location: Embassy Suites by Hilton - Little Rock, Arkansas

# Introduction

This NSF workshop brings together ExpandQISE investigators, NSF Program Directors, and other stakeholders to foster a collaborative environment that amplifies collective progress and innovation in the evolving and expanding field of quantum information science and engineering (QISE). By convening researchers who are developing and implementing projects focused on expanding QISE capabilities, the workshop aims to facilitate the exchange of ideas, share best practices, and address common challenges. This event will encourage interdisciplinary dialogue, strengthen partnerships between institutions, and catalyze new collaborations that align with the broader goals of enhancing the workforce, educational outreach, and research infrastructure related to QISE. Such interactions not only support the individual growth of projects but also contribute to a cohesive national strategy for advancing quantum technologies and education.

# Workshop Agenda

This NSF ExpandQISE workshop is by invitation only. Each invited speaker and participant must register for the workshop by Dec. 13th, 2024. Please see the registration tab of this site:

https://uapb.edu/administration/research-innovation-and-economic-development/expand-qise/.

Detailed agenda for invited speakers talk titles will be uploaded by the first week of January, 2025.

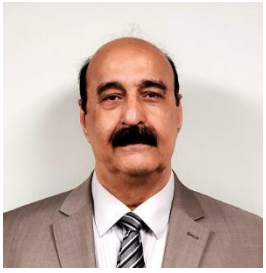
For any questions and help, please refer to the block agenda below which will be helpful in making travel arrangements to Little Rock on Jan. 16th to Jan. 18th, 2025, for those traveling from outside Arkansas.

# Organizing Committee

## Organizing Group

Dr. Tomasz Durakiewicz
NSF Directorate for Mathematical and
Physical Sciences (MPS)
Division of Materials Research (DMR)

Dr. Qinglong Jiang
Associate professor of chemistry
University of Arkansas at Pine Bluff
FESS Fellow



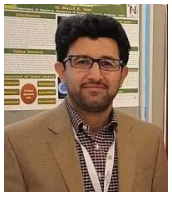
Dr. Mansour Mortazavi
Vice Chancellor for Research
Professor of Physics
University of Arkansas at Pine Bluff
Arkansas Research Alliance Fellow

Dr. Grant Wangila
Interim Dean of the School of Arts and Sciences
Professor of Chemistry
University of Arkansas at Pine Bluff

Azarin Yazdani
Research Project Analyst
University of Arkansas at Pine Bluff

## Academic Group

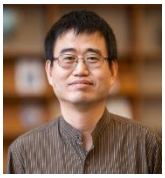
Dr. Hugh Churchill
Professor of Physics
University of Arkansas
Arkansas Research Alliance Fellow



Dr. Emad Omar Badradeen
Assistant Professor of Physics
University of Arkansas at Pine Bluff

Dr. Jita Tian
Associate Professor of Physics & Astronomy
University of Wyoming
Director of CQISE

Dr. Wei Du
Associate Professor of Electrical Engineering and Computer Science
University of Arkansas



Dr. Chuanwei Zhang
Professor of Physics
Washington University
APS Fellow

Dr. Gregory Guisbiers
Associate Professor of Physics and Astronomy
University of Arkansas at Little Rock

Dr. Daoyuan Wang
Associate Professor of Chemistry
University of Arkansas at Pine Bluff

**UAPB Logistics Coordinator**
Genevia Thomas
Project Program Specialist

**UAPB IT and Media**
Mary Hester-Clifton
Director of Communications

# Keynote Speakers

**Dr. Denise Caldwell** is the Senior Advisor at the National Science Foundation Directorate for Mathematical and Physical Sciences (MPS). After an academic career in Atomic, Molecular, and Optical physics, Denise Caldwell joined the National Science Foundation. Between her scientific focus and bureaucratic responsibilities, Caldwell was uniquely situated to recognize the value in supporting the Institute for Quantum Information and Matter in the late 2000s.

**Dr. An-Ping Li** is the Leader of the Scanning Tunneling Microscopy Group and the Heterogeneities in Quantum Materials Theme within the Center for Nanophase Materials Sciences (CNMS) at the U.S. Department of Energy's Oak Ridge National Laboratory (ORNL). Dr. Li's research focuses on the synthesis and fundamental properties of low-dimensional and quantum materials for energy and quantum information applications. His expertise lies in advanced techniques such as scanning tunneling microscopy (STM), molecular beam epitaxy, and controlled on-surface chemical reactions.

# First Annual Workshop
# NSF Expanding Quantum Information Science and Engineering

Location: Embassy Suites by Hilton, Little Rock, Arkansas
11301 Financial Centre Parkway, Little Rock, AR 72211
January 16th – 18th, 2025

**Day 1**

| | |
|---|---|
| 4:00 - 5:00 PM | Arrival, and Registration |
| 6:00 - 8:00 PM | Welcome and Introduction (by **Dr. Mansour Mortazavi**) |
| | Keynote Seminar, and Dinner (Hosted by **Dr. Grant Wangila**) |

**Keynote Speaker Dr. Denise Caldwell:** Quantum Information Science and Engineering at the National Science Foundation

| | |
|---|---|
| | Workshop Goals (by **Dr. Tomasz Durakiewicz**) |
| 8:00 PM | Networking Session |

**Day 2**

| | |
|---|---|
| 8:00 - 8:30 AM | Breakfast, Registration |
| 8:30 - 9:00 AM | Keynote Seminar: **Dr. An-Ping Li** (Hosted by **Dr. Qinglong Jiang**) |
| 9:00 - 10:45 AM | **Workshop Session 1**<br>**Quantum Computing and Chip Design: Innovations and Challenges**<br>(Hosted by **Dr. Hugh Churchill**) |
| 10:45 - 11:00 AM | Break |
| 11:00 AM - 12:00 PM | **Workshop Session 2**<br>**Advances in Atomic, Molecular, and Optical Physics**<br>(Hosted by **Dr. Chuanwei Zhang**) |
| 12:00 - 1:30 PM | Lunch |
| 1:30 - 3:00 PM | **Workshop Session 3**<br>**Quantum Materials and Education: Bridging Research and Learning**<br>**(**Hosted by **Dr. Jifa Tian)** |
| 3:00 - 3:20 PM | Break |
| 3:20 - 5:30 PM | **Workshop Session 4**<br>**Quantum Applications: Exploring Diverse Frontiers**<br>(Hosted by **Dr. Gregory Guisbiers**) |
| 5:30 - 6:00 PM | Workshop Sessions Wrap-Up (by **Dr. Tomasz Durakiewicz**) |
| 6:00 - 7:30 PM | Networking Dinner |
| 7: 30 PM | Evening Activities and Networking Session |

**Day 3**

| | |
|---|---|
| 8:00 - 9:00 AM | Breakfast |
| 9:00 - 10:30 AM | Introduction of Group Discussions (Hosted by **Dr. Tomasz Durakiewicz**) |

**Group Discussion 1** - Collaborative Research Opportunities: Discovery- based research on properties of quantum materials, light-matter interactions, material synthesis, scalability, etc.

Leads/Scribes: **Dr. Hugh Churchill**, **Dr. Jifa Tian** and **Dr. Qinglong Jiang**

**Group Discussion 2** - Quantum Education: Innovations in educational strategies to recruit and prepare a diverse domestic quantum workforce pipeline, hiring of research/students.

Leads/Scribes: **Dr. Emad Badradeen** and **Dr. Daoyuan Wang**

**Group Discussion 3** - Research Infrastructure: Innovation ecosystems centered around quantum translational research and alignment with government labs/industry needs towards quantum/government policy, international level problems.

Leads/Scribes: **Dr. Chuanwei Zhang**, **Dr. Gregory Guisbiers,** and **Dr. Wei Du**

| | |
|---|---|
| 10:30 - 11:00 AM | Break |
| 11:00 AM -12:00 PM | Group Discussion Results<br>NSF PM read out<br>Panel Discussion<br><br>Hosted by **Dr. Tomasz Durakiewicz**,<br>Panelists: **Dr. Grant Wangila**, **Dr. Hugh Churchill**, **Dr. Jifa Tian**, **Dr. Qinglong Jiang**, and **Dr. Chuanwei Zhang** |
| 12:00 PM | Lunch, Closing Session and Feedback, Q&A |
| 1:00 PM | UALR and UAPB Laboratories Visits (optional) |

**Workshop Sessions**

**1st Session: Quantum Computing and Chip Design: Innovations and Challenges**

(Hosted by **Dr. Hugh Churchill**)

*Description*: This session will explore the latest advancements in quantum computing, focusing on the design and development of quantum chips and quantum programming. Experts will discuss the technical challenges and innovative solutions driving the future of quantum computing.

1. **Dr. Markus Allgaier**, University of North Dakota, "Spectrally-multiplexed photon pair sources for Quantum Sensing and Networking."

2. **Dr. Shuangbao "Paul" Wang**, Morgan State University, "QGP: A Quantum Good Authentication Protocol."

3. **Dr. John Yi**, Winston-Salem State University, Clemson University, University of Rochester, and University of Maryland, "Building the Future of Quantum Information Science and Engineering at Winston-Salem State University."

4. **Dr. You Zhou**, University of Maryland, "Exploring exchange interactions between the persistent spin helix and defect spin qubits for quantum information."

5. **Dr. Yusui Chen**, New York Institute of Technology, "Positivity-preserving non-Markovian master equation."

6. **Dr. Dmitri Babikov**, Marquette University, "Simulating Quantum Molecular Dynamics on Quantum Computers."

7. **Dr. Vinod Menon**, City College of New York – CUNY, "Leveraging synthetic degrees of freedom for quantum state engineering in photonic chips."

8. **Dr. Ying Mao**, Fordham University, "Distributed Quantum-Classical Computing with Efficient Circuit Cutting."

9. **Dr. Jianqing Liu**, NC State University, "Virtual Quantum Networks: From Foundations to Field Tests."

10. **Dr. Peter Bierhorst**, University of New Orleans, "Providing Hands-On Experience With A Quantum Network."

11. **Dr. Sonia Lopez Alarcon**, Rochester Institute of Technology, "Quantum Compilation: Elevating Performance and Scalability with Input Adaptivity and Machine Learning."

12. **Dr. Christino Tamon**, Clarkson University, "Continuous Quantum Walks."

13. **Dr. Wenchao Ge**, University of Rhode Island, “Quantum Correlations in Quantum Approximate Optimization Algorithms and Their Implementation.”

14. **Dr. David Wisbey**, Saint Louis University, “Microwave resonator probes of quantum materials for advancing qubit platforms.”

15. **Dr. Xuemei Cheng**, Bryn Mawr College, “Research and Education Center for Quantum Materials and Quantum Sensing.”

**2nd Session: Advances in Atomic, Molecular, and Optical Physics**

(Hosted by **Dr. Chuanwei Zhang**)

*Description*: Dive into the latest breakthroughs in atomic, molecular, and optical physics. This session will cover recent research findings, experimental techniques, and theoretical advancements that are shaping our understanding of quantum phenomena at the atomic and molecular levels.

1. **Dr. Samir Bali**, Miami University, “Bright, highly polarization-squeezed light beam for quantum metrology.”

2. **Dr. Xuejian Wu**, Rutgers University-Newark, “Scalable Quantum Gravimeters with a Single Laser Beam.”

3. **Dr. Vanita Srinivasa**, University of Rhode Island, “Hybrid Solid-State Modular Quantum Systems.”

4. **Dr. David Strubbe**, University of California, Merced, “First-Principles Calculation of Quantum Defects via the Spin-Flip Bethe-Salpeter Equation.”

5. **Dr. Chuanwei Zhang**, University of Texas at Dallas / Washington University in St. Louis, “Neutral atoms based quantum information processing.”

6. **Dr. Maren Mossman**, University of San Diego, “Quantum analog simulation with Bose-Einstein condensates in flexible light fields.”

7. **Dr. Christian Arenz**, Arizona State University, “Reimagining adaptive quantum algorithms.”

**3rd Session: Quantum Materials and Education: Bridging Research and Learning**

(Hosted by **Dr. Jifa Tian**)

*Description*: This session aims to connect cutting-edge research in quantum materials with educational initiatives. Participants will learn about the latest discoveries in quantum materials and how these can be integrated into educational curricula to inspire the next generation of quantum scientists.

1. **Dr. Jinjia Xu**, University of Missouri-St. Louis, "Integrating Single Molecules to Two-Dimensional Materials toward Quantum Devices."

2. **Dr. Wei Guo**, FAMU-FSU College of Engineering, National High Magnetic Field Laboratory, "Quantum Fluids and Solids as Platforms for Quantum Science and Engineering."

3. **Dr. Jifa Tian**, University of Wyoming, "Phase Engineering in 2D Topological Superconductors and Building QISE Workforce for the Future."

4. **Dr. Yu Gong**, College of Charleston, "Coherent Phonon Generation and Control in 2D Layered van der Waals Materials."

5. **Dr. Nikolai Kalugin**, New Mexico Tech, "Quantum materials research and education program at New Mexico Tech."

6. **Dr. Joseph Corbett**, Miami University, "A Deep-Dive into the alpha-Ta Growth on Oxides for Superconducting Resonator."

7. **Dr. Hanna Terletska**, Middle Tennessee State University, "Quantum at MTSU: Advancing Education, Research, and Workforce Development in Middle Tennessee."

8. **Dr. Robin Cote**, University of Massachusetts Boston, "EQUIP-UMB-Expand Quantum Information Programs at UMass Boston."

9. **Dr. Steve Smith**, South Dakota School of Mines and Technology, "Nonlinear Optical Properties of 2D Materials."

10. **Dr. Sugata Chowdhury**, Howard University, "A Quantum Science Education and Research Program for HBCUs: Exotic Physics and Applications of Solid-State Qubits."

11. **Dr. Emad Badradeen**, University of Arkansas at Pine Bluff, "QuAPB project at UAPB, Goals Objectives and Challenges."

12. **Dr. Gregory Guisbiers**, University of Arkansas at Little Rock, "Synthesis of quantum dots by pulsed laser ablation in liquids."

13. **Dr. Qinglong Jiang**, University of Arkansas at Pine Bluff, "Quantum Dot of Perovskites for Light-Emitting/Optics-Electronic Devices and Quantum Education in UAPB."

14. **Dr. Tansel Karabacak**, University of Arkansas at Little Rock, “Novel Approaches to Nanostructure Synthesis: Tellurium quantum dots via Glancing Angle Deposition and VOx via Hot Water Treatment.”

15. **Dr. Angela M. Kelly**, Stony Brook University, “The QISE Education Continuum: Aligning Workforce Needs with Curriculum, Instruction, and Outreach.”

**4th Session: Quantum Applications: Exploring Diverse Frontiers**

(Hosted by **Dr. Gregory Guisbiers**)

*Description*: This session will highlight the wide range of applications for quantum technologies across various fields. From quantum cryptography to quantum sensing, experts will discuss how these technologies are being applied to solve real-world problems and what the future holds for quantum applications.

1. **Dr. Chong Zu**, Washington University in St. Louis, “Quantum sensing with solid-state spin defects.”

2. **Dr. Jayasimha Atulasimha**, Virginia Commonwealth University, “Scalable quantum control with nanoscale magnetic devices.”

3. **Dr. Jie Dong**, Southern Illinois University Edwardsville, “Investigating biomass pretreatment with nanodiamond quantum sensors.”

4. **Dr. Tian Li**, University of Tennessee, Chattanooga, “Quantum Sensing on a Deployed Metro-Scale Quantum Network.”

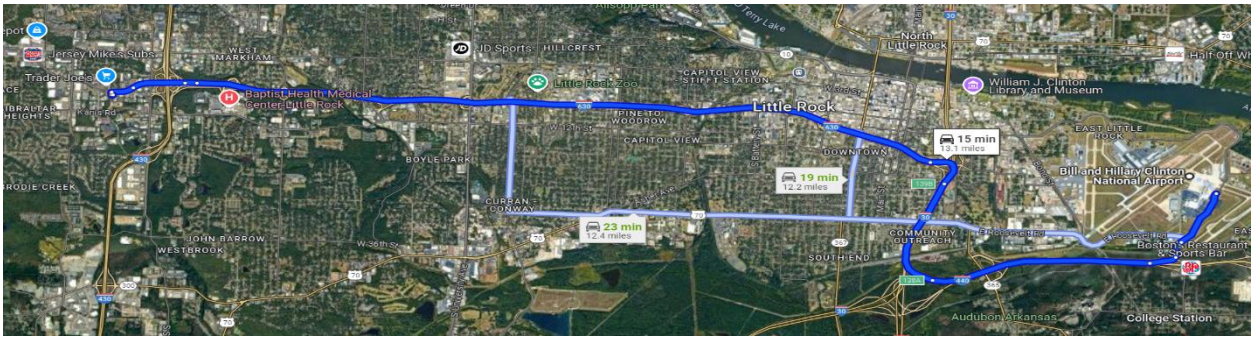
5. **Dr. Ayush Asthana**, University of North Dakota, “Quantum algorithms for relativistic quantum chemistry.”

6. **Dr. Sathish Kumar**, Cleveland State University, "Reinforcement Learning-Based Design and Optimization of Programmable Quantum Sensor Circuits."

7. **Dr. Gary Cheng**, Purdue University, “Laser nanoscale strain engineering of topological 2D superconductor for quantum computing.”

# Transportation

*Uber, Lyft*




## Little Rock

Pinnacle Mountain State Park

William J. Clinton Presidential Library

Museum of Discovery

Little Rock Zoo

Emerald Park

Burns Park

## Surroundings (by driving)

Hot Springs National Park (1 hour)

Buffalo National River (2 hours)

Petit Jean State Park (1 hour)

Crater of Diamonds State Park (2 hours)

Mount Magazine State Park (2 hours)

Lake Catherine State Park (1 hour)

# List of Workshop Participants

| | | | |
|---|---|---|---|
| Markus | Allgaier | Dr. | University of North Dakota |
| Christian | Arenz | Dr. | Arizona State University |
| Ayush | Asthana | Assistant Professor | University of North dakota |
| Jayasimha | Atulasimha | Professor | Virginia Commonwealth University |
| Dmitri | Babikov | Professor | Marquette University |
| Emad | Badradeen | Assistant Professor | University of Arkansas at Pine Bluff |
| Samir | Bali | Professor | Miami University |
| Ryan | Behunin | Mr. | Northern Arizona University |
| Peter | Bierhorst | Associate Professor | University of New Orleans |
| Denise | Caldwell | Senior Advisor | NSF/ Columbia University |
| Ashish | Chaudhary | Mr. | University of Arkansas at Pine Bluff |
| Yusui | Chen | Associate Professor | New York Institute of Technology |
| Gary | Cheng | Professor | Purdue University |
| Xuemei | Cheng | Professor | Bryn Mawr College |
| Maoding | Cheng | Mr. | University of Arkansas at Pine Bluff |
| Sugata | Chowdhury | Assistant Professor | Howard University |
| Hugh | Churchill | Professor | University of Arkansas, Fayetteville |
| Joseph | Corbett | Assistant Professor | Miami University |
| Robin | Cote | Professor | University of Massachusetts Boston |
| Alex | Cronin | Program Director | NSF |
| David | Darwin | Program Director | National Science Foundation TIP/ITE |
| Jie | Dong | Associate Professor | Southern Illinois University Edwardsville |
| Wei | Du | Associate Professor | University of Arkansas, Fayetteville |
| Tomasz | Durakiewicz | Dr. | National Science Foundation |
| Wenchao | Ge | Assistant Professor | University of Rhode Island |
| Yu | Gong | Assistant Professor | College of Charleston |
| Gregory | Guisbiers | Associate Professor | University of Arkansas at Little Rock |
| Wei | Guo | Professor | FAMU-FSU College of Engineering, National High Magnetic Field Laboratory |
| Wu | He | Program Director | National Science Foundation |
| Mary | Hester-Clifton | Director of Communications | University of Arkansas at Pine Bluff |
| Qinglong | Jiang | Associate Professor | University of Arkansas at Pine Bluff |
| Nikolai | Kalugin | Professor | New Mexico Tech |
| Tansel | Karabacak | Professor of Physics | University of Arkansas at Little Rock |
| Angela | Kelly | Professor | Stony Brook University |
| Alexander | Khanikaev | Professor | University of Central Florida |
| Michael | Kolodrubetz | Professor | University of Texas at Dallas |
| Sathish | Kumar | Associate Professor | Cleveland State University |
| Tian | Li | Assistant Professor | University of Tennessee, Chattanooga |

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|---|---|---|---|
| An-Ping | Li | Dr./ Group Leader | Oak Ridge National Lab |
| Jianqing | Liu | Assistant Professor | NC State University |
| Sonia | Lopez Alarcon | Dr. | Rochester Institute of Technology |
| Ying | Mao | Associate Professor | Fordham University |
| Mansour | Mortazavi | Vice Chancellor | University of Arkansas at Pine Bluff |
| Matthew | McCune | Program Director | NSF |
| Vinod | Menon | Professor | City College of New York - CUNY |
| Maren | Mossman | Assistant Professor | University of San Diego |
| Michael | Noel | Professor | Bryn Mawr College |
| Vinay | Raj | Assistant Professor | University of Arkansas at Pine Bluff |
| Shrawan | Roy | Dr. | University of Arkansas at Pine Bluff |
| Manoj | Shah | Dr. | University of Arkansas at Pine Bluff |
| Mickey | Slimp | Executive Director | Great Plains Network/University of Missouri |
| Steve | Smith | Dr. | South Dakota School of Mines and Technology |
| Vanita | Srinivasa | Assistant Professor | University of Rhode Island |
| R. Anne | Stetler | AAAS STPF fellow | NSF TIP |
| David | Strubbe | Associate Professor | University of California, Merced |
| Christino | Tamon | Professor | Clarkson University |
| Hanna | Terletska | Dr. | Middle Tennessee state University |
| Jifa | Tian | Associate Professor | University of Wyoming |
| Shuangbao | Wang | Professor | Morgan State University |
| Daoyuan | Wang | Associate Professor | University of Arkansas at Pine Bluff |
| Grant | Wangila | Professor | University of Arkansas at Pine Bluff |
| Aldine | Willacey | Mr. | University of Arkansas at Pine Bluff |
| Emmanuel | Wangila | Dr. | University of Arkansas at Pine Bluff |
| David | Wisbey | Dr. | Saint Louis University |
| Xuejian | Wu | Assistant Professor | Rutgers University-Newark |
| Jinjia | Xu | Assistant Professor | University of Missouri-St. Louis |
| Azarin | Yazdani | Research Project Analyst | University of Arkansas at Pine Bluff |
| John | Yi | Professor | Winston-Salem State University |
| Chuanwei | Zhang | Professor of Physics | University of Texas at Dallas / Washington University in St. Louis |
| You | Zhou | Assistant Professor | University of Maryland |
| Chong | Zu | Assistant Professor | Washington University in St. Louis |