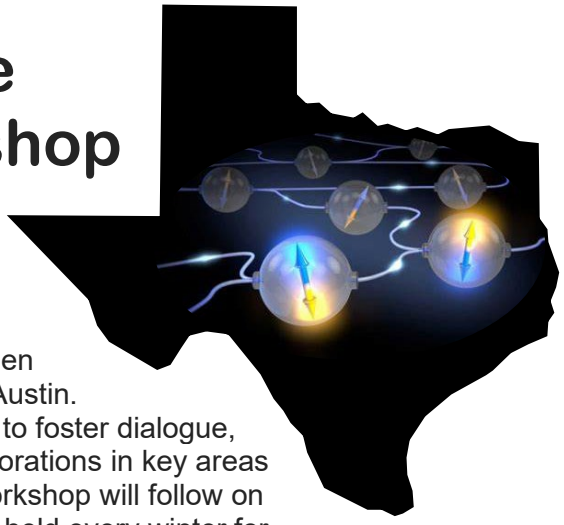
Joint Quantum Science and Technology Workshop



College Station, TX
January 15 -16, 2025

This inaugural workshop is a collaborative effort between Texas A&M University and the University of Texas at Austin. The workshop aims to bring together faculty members to foster dialogue, identify shared interests, and establish potential collaborations in key areas of quantum science and technology. This inaugural workshop will follow on the Physics of Quantum Electronics (PQE) colloquium held every winter for over fifty years. The topics covered will focus on the overlap of those featured at this year's PQE and topics of special interest to the members of the UT Quantum Institute.

The workshop will focus on the following areas:

- **Quantum Algorithms**: Innovations and applications in quantum computing and algorithmic development.
- **Quantum Metrology**: Advancing precision measurement techniques using quantum phenomena.
- **Quantum Sensing:** Concepts and techniques; from remote sensing to super-resolution microscopy and quantum sensing at the nanoscale.
- **Quantum Optics Frontiers:** Acceleration radiation and temperature; quantum thermodynamics; quantum optics in curved space-time and tests of quantum gravity.
- **Quantum Informatics**: Cryptography; secure communication.
- **Quantum Coherence Phenomena:** Electromagnetically induced transparency, lasing without inversion, applications of molecular coherence in enhanced sensing - from remote to nanoscale sensing (FAST CARS, FASTER CARS, *etc*).
- **Quantum Materials**: Exploring novel materials for quantum applications.
- **Quantum Devices and Systems**: Development and integration of technologies such as quantum photonics, circuits, and sensors.

Workshop objectives:

1. **Exchange Expertise**: Share experiences and insights from quantum institutes at UT-Austin and Texas A&M.
2. **Foster Collaboration**: Identify and prioritize areas of shared interest among participants. Build the quantum ecosystem in Texas and beyond.
3. **Shape Future Support**: Outline actionable recommendations for desirable state-level support for quantum science initiatives.

Organizing Committee: Marlan Scully (Director) and Alexei Sokolov, IQSE, TAMU;

Xiaoqin Elaine Li and Xiuling Li, Texas Quantum Institute co-directors, UT-Austin

The workshop is sponsored by the IQSE - Institute for Quantum Science and Engineering,
by Dr. Joe Elabd, Vice Chancellor for Research, TAMU System,
and by Dr. Mark Zoran, Dean of the College of Arts and Sciences, TAMU.

TAMU-UT-Austin Joint Quantum Science and Technology Workshop Schedule

Location: IQSE Conference room, MPHY#578

Zoom access for remote participants
https://tamu.zoom.us/j/98156251523?pwd=QVdSdGxtL1UyY0g1L083SU5QR0QrUT09
Meeting ID: 981 5625 1523
Passcode: 297578

Time	Session	Details
Wednesday, January 15th		
8:30 am	Breakfast	
9:00 - 9:15 am	Welcome and Opening Remarks	Marlan Scully, Joe Elabd, and Mark Zoran
9:15 - 9:45 am	Introduction to TAMU IQSE and UT-Austin TQI	Elaine Li / Xiuling Li, and Marlan Scully / Alexei Sokolov
10:00 - 10:15 am	Break: Coffee and Posters	
10:00 - 11:00 am	**Victor Weisskopf Award** Presentation and Session	Award recipients: Vaclav Spicka (Czeck Academy of Sciences), Norbert Kro (Hungarian Academy of Sciences). Plus, a lecture by Wolfgang Schleich.
11:00 - 11:30 am	Luiz Davidovich (TAMU)	"Role of Entanglement and Discord in the Estimation of Noise Parameters"
11:30 - 12:00 pm	Mark Raizen (UT-Austin)	"Isotopes for Medicine and a New Test of Quantum Mechanics"
12:00 - 1:00 pm	**Lunch Break**	Posters and Faculty Networking Discussion: Future Quantum Workshops in Texas (input invited through Google file)
Quantum Sensing and Metrology		
1:00 - 1:20 pm	Keji Lai (UT-Austin)	"Advancing Quantum Acoustic Metrology", TQI Thrust Leader
1:20 - 1:40 pm	Olga Kocharovskaya (TAMU)	"Prospects for Nuclear Clocks and Quantum Memories"
1:40 - 2:00 pm	Srinivas Bettadpur (UT-Austin	"Quantum Sensors for Space Science", Aerospace Engineering, Director of NASA Quantum Pathway Institute
2:00 - 2:20 pm	Aleksei Zheltikov (TAMU)	"Tailored quantum light and emergent classicality from nonlinear quantum fields"
2:20 - 2:40 pm	Ed Yu (UT-Austin)	"Electrostatic control of strain and quantum light emission", MRSEC director
2:40 - 2:50 pm	Short Break	

Time	Session	Details
2:50 - 3:05 pm	Jeremy Glick and Paul Kunz	"Rydberg Quantum Sensor", Army Research Quantum Division/UT-Austin
3:05 - 3:20 pm	Sean Blakley	"Spin-to-Charge Conversion in NV Centers", Army Research Quantum Division
3:20 - 3:40 pm	Girish Agarwal (TAMU)	"Squeezed States as Ultimate Quantum Probes for Heisenberg Limited Sensing"
3:40 - 4:00 pm	Shoufeng Lan (TAMU)	"Reciprocal Quantum Electrodynamics"
4:00 - 4:15 pm	Break for Discussion, Coffee, Posters, etc.	
Quantum Algorithm and Quantum Simulation		
4:15 - 4:55 pm	Matteo Ippoliti (UT-Austin)	"Logical operations on encoded qubits from coherent errors and syndrome measurements"
4:35 - 4:55 pm	Shenglong Xu (TAMU)	"Information Spreading and Decoding in Quantum Many-Body Systems"
4:55 - 5:15 pm	Nick Hunter-Jones (UT-Austin)	"Random circuit sampling and verifiable quantum advantage"
5:15 - 5:35 pm	Joaquin Rodriguez Nieva (TAMU)	"Frontiers of statistical mechanics in synthetic quantum matter"
5:35 - 5:45 pm	Discussion	

6:00 pm: Dinner in honor of the Victor Weisskopf Award recipients, continued Networking and Discussions.

Thursday, January 16th		
Quantum Optics Frontiers		
8:30	Breakfast	
9:00 - 9:20 am	Marlan Scully (TAMU)	“From Quantum Thermodynamics to Quantum Optics in Curved Space-Time”
9:20 - 9:40	Anatoly Svidzinsky (TAMU)	“Time reflection of light from a quantum perspective and vacuum entanglement”
9:40 - 10:00	Yusef Maleki (TAMU)	“Quantum eraser with gravity”
10:00 - 10:20	Vitaly Kocharovsky (TAMU)	“Nature of Quantum Supremacy and Atomic Boson Sampling”
10:20 - 10:35	Break: Coffee and Posters	
Quantum Photonics		
10:35 am	Gary Eden (TAMU and UIUC)	“Interferometer in an Atom: Controlled Interference Between THz Quantum Coherences”
	Xiuling Li (UT-TQI co-director)	“Spin Defects in UWBG Hosts and Photonic Integration”
	Vanderlei Bagnato (TAMU)	“Cold Atoms and Quantum Turbulence”
11:45 – 12:00	Hybrid Session	William Unruh, K. R. Sreenivasan, etc.
12:00 - 1:00 pm	Lunch Break	Posters, Continued Discussion, and Networking
Quantum Materials *etc*.		
1:00 – 1:20	Phil Hemmer (TAMU)	“Fluorescent Nanodiamonds for Quantum-enhanced Bio-sensing”
1:20 – 1:40	Sean Roberts (UT-Austin)	"Visualizing Exciton Transport in Singlet Fission Materials"
1:40 – 2:00	Dong Hee Son (TAMU)	“Colloidal Quantum Dots and Their Assemblies as the Source of Quantum Photons”
2:00 – 2:20	Jeff Prevost (UT-San Antonio)	“Introducing the UTSA Quantum Resilience Research Portfolio”
2:20 – 2:40	Zhenhuan Yi (TAMU)	“Nonclassical States of Light for Quantum Microscopy”
2:40 – 3:00	Richard Miles (TAMU)	“Quantum LIDAR”

3:00 - 3:15 pm	Break: Coffee and Posters	
3:15 - 4:20 pm	Hybrid Session: Introducing Your Research Portfolio	Jonas Karthein (TAMU): “Quantum Sensing with Nuclei” Mit Naik: “Excitons in 2D van der Waals heterostructures” Junyeong Ahn: “Quantum geometry and physical properties of condensed matter” Wennie Wang: “Optoelectronic properties of defects in 2D materials” Tim Rogers, Quantum Solutions @ IonQ
Quantum-classical interface		
4:20 – 4:40 pm	Suhail Zubairy (TAMU)	“Photon Transport through Optical Waveguide”
4:40 - 5:00 pm	Leon Cohen (CUNY)	“The Two-Time Conditional Standard Deviation in Classical and Quantum Mechanics”
5:00 - 5:30 pm	Sergio Cantu (QuEra, incoming new faculty member at TAMU)	“Advancements in Programmable Gate-Based Quantum Processing with Neutral Atom Arrays”
5:30 - 6:00 pm	Discussion	
6:00 pm	End of Workshop	