# Cornell Quantum Day
## Book of Abstracts
(November 3, 2025)

## Oral Presentations

**Speaker: Darren Pereira**
**Advisor:** Erich Mueller, Physics
**Title**: Kinetic-magnetism crossover in Fermi-Hubbard quantum simulators.
**Abstract:** Many quantum information phenomena can be best understood through the lens of a quantum game, in which a referee interacts with one or more quantum "players" according to certain rules. In this talk I will present a computational perspective on quantum games, and discuss connections to both cryptography and cosmology.

**Speaker: Or Katz**
**Position:** Associate Professor, Applied and Engineering Physics
**Title:** Programmable quantum simulations with trapped-ion spins
**Abstract:**

**Speaker: Tim Skaras**
**Advisor(s):** Paul Ginsparg, Physics
**Title:** Process Tomography for Clifford Unitaries
**Abstract:** We present an algorithm for performing quantum process tomography on an unknown n-qubit unitary C from the Clifford group. Our algorithm uses Bell basis measurements to deterministically learn C with 4n + 3 queries, which is the asymptotically optimal query complexity. In contrast to previous algorithms that required access to the adjoint of C to achieve optimal query complexity, our algorithm achieves the same performance without using the adjoint of C. Additionally, we show that the algorithm is robust to perturbations and can efficiently learn the closest Clifford to an unknown non-Clifford unitary U using a query overhead that grows logarithmically with the number of qubits.

**Speaker: Nick Spooner**
**Position:** Assistant Professor, Cornell Bowers
**Title:** Computational quantum games

**Abstract:** Many quantum information phenomena can be best understood through the lens of a quantum game, in which a referee interacts with one or more quantum "players" according to certain rules. In this talk I will present a computational perspective on quantum games, and discuss connections to both cryptography and cosmology.

**Speaker: Michael Lawler**
**Position:** Adjunct Professor, Physics
**Title:** Coding Phases and Hardware-Tailored Codes
**Abstract:** The quantum capacity theorem is a triumph of quantum information science. Proven three times decades ago by Lloyd (1997), Shor (1998) and Devetek (2005), each time with a successively higher degree of rigor, it establishes the optimal coherent information as the quantum information quantity associated with the maximum amount of quantum information that can be sent through a quantum channel. Yet its full implications are far from understood. In this talk, I will focus on its implications for quantum error correction in quantum computing. Recognizing a direct parallel between the theorem and Jaynes' maximum entropy principle that underlies statistical mechanics, I will argue the theorem establishes the notion of a "coding phase." Further, I will apply the theorem to a simple quantum channel model of a quantum computer, and find in this case the optimization process alone leads to classical codes. Though the theorem provides a recipe to turn these into ideal quantum codes, I will discuss practical alternatives. I will conclude by discussing how these observations and results could provide us with hardware-tailored codes that can be implemented on quantum computers.

**Panel discussion:** Inside Cornell Quantum: Today's Breakthroughs, Tomorrow's Possibilities
**Featuring**:
**Krystyn Van Vliet**: As Vice President for Innovation and External Engagement Strategy, Van Vliet supports innovation, technology transfer and external partnerships across all Cornell campuses. Her responsibilities encompass intellectual property licensing, incubation and acceleration of startup companies, as well as external partnerships and engagement with public and private stakeholders to advance university-level initiatives and partnerships. Her portfolio includes Center for Technology Licensing activities and the Office of Corporate Engagement.
**Gregory Fuchs**: Fuchs earned his Ph.D. in Applied Physics from Cornell University in 2007. Afterward, he moved to the University of California, Santa Barbara as a postdoctoral associate. In 2011, he joined the Cornell faculty of Applied and Engineering Physics. In 2012 he received a Young Investigator Award from the Air Force Office of Scientific Research, in 2013 he received an Early Faculty Career Award from the National Science

Foundation along with the Presidential Early Career Award for Scientists and Engineers, and in 2014 he received the Early Career Award from the Department of Energy.

**Eun-ah Kim**: My research interests lie in the theoretical study of the collective phenomena condensed matter systems exhibit, and in understanding how such phenomena emerges from microscopic physics. Especially, I have been interested in the physics of strongly correlated systems: systems consisting of many strongly interacting degrees of freedom. Strong correlations can lead to a surprisingly rich diversity of novel phenomena that are highly non-trivial from a single particle perspective. Over the last few decades, new experimental discoveries, through the development of new experimental probes and the fabrication of ever more exotic materials and devices, have been raising unexpected and conceptually deep questions. The possibility of obtaining a non-trivial understanding through a close interaction and synergy with experimental colleagues make the theoretical study of this field exciting and rich.

**Debdeep Jena**: Debdeep Jena is the David E. Burr Professor of Engineering at Cornell University. He is in the departments of Electrical and Computer Engineering and Materials Science and Engineering, and is a field member in the department of Applied and Engineering Physics. He joined Cornell in 2015 from the faculty at Notre Dame where he was since August 2003, shortly after earning the Ph.D. in Electrical and Computer Engineering from the University of California, Santa Barbara (UCSB).

## Poster Presentations

Anand Ithepalli (Jena/Xing Group)
"Improvements in superconducting microwave resonators and JJs on epitaxial nitride superconductors"

Kaiyuan Ji (Wilde Group)
"Retrocausal capacity of a quantum channel"

Edward Lee (Ibrahim Group)
"QuASI: Qubit Accessible Simulation Interface for Source-Agnostic Time-Domain Control Signals"

Amit Rajapurohita (Jena/Xing Group)
"Tantalum Nitride superconducting coplanar waveguide resonators"

Manas Verma (Jena/Xing Group)

“Towards Epitaxial nitride qubits grown by MBE”

Hangwang Yang (Jena/Xing Group)

Fei Yu (Weisner Group)
“My poster title is 3D Printed Superconductors via Soft Matter Self-Assembly”