



UCF

# FACULTY RESEARCH TALKS

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Zoom talk | Friday, April 11, 2025 | Noon to 1 p.m.



PRESENTER 1:  
**CHRISTIAN  
HEIDE**

Assistant Professor  
Physics and CREOL

## Controlling Electrons with Attosecond Precision: A Path Towards Room-Temperature Quantum Electronics

Well-controlled light fields can coherently control electron dynamics with attosecond precision. In solids, this allows for femtosecond-fast current injection caused by sub-cycle-controlled quantum interferometry, while in nanostructures, light-field-controlled electron emission allows for attosecond-fast gates to perform electric field sampling, the analog of a petahertz oscilloscope. More recently, purpose-tailored light fields have been utilized to generate exotic out-of-equilibrium states, so-called Floquet states, with novel optical and electrical properties, to be used for quantum logic devices.

Heide received his bachelor's, master's and doctoral degrees in physics from the University of Erlangen-Nürnberg, working on light-field-driven phenomena in quantum materials. In 2020, he moved to Stanford University as a postdoctoral fellow funded by the Alexander von Humboldt Foundation. Since January 2025, he has been a faculty member at UCF. His research explores various topics in ultrafast light-matter interaction, coherent control and extreme nonlinear optics. Combining these topics, he is working on nanostructures, which are fast enough to probe the oscillating electric field of light — a petahertz oscilloscope.



PRESENTER 2:  
**MENGJIE LI**

Assistant Professor  
School of Modeling,  
Simulation and  
Training

## Data Driven Digital Twin in Effective Integration of Distributed Energy Resources

In this presentation, Dr. Li will discuss her research on the role of data-driven digital twins in the digital transformation of the energy market. As the grid evolves from a centralized, hierarchical structure to a decentralized configuration with an increasing number of distributed energy resources, the need to comprehensively understand the performance, reliability, durability and optimization of renewable energy systems becomes more critical than ever.

Li holds secondary joint appointments in the Department of Computer Science, the Department of Materials Science, and the Department of Electrical and Computer Engineering. She is also an affiliated member of the Resilient, Intelligent, and Sustainable Energy Systems cluster and the Florida Solar Energy Center. Her current research focuses on data-driven approaches to understanding the reliability and durability of photovoltaic (PV) cells and modules, degradation behaviour of PV systems, forecasting PV system energy output, performance loss rate estimation, anomaly detection, predictive maintenance, and autonomous detection of energy infrastructure for the effective integration of distributed energy resources.



PRESENTER 3:  
**HANQIN CAI**

Assistant Professor  
Statistics and Data  
Science

## Zeroth-Order Regularized Optimization with Approximately Sparse Gradients and Adaptive Sampling

In this talk, HanQin Cai considers the problem of minimizing a high-dimensional objective function, using only noisy evaluations of the function. Such optimization is also called derivative-free, zeroth-order or black-box optimization. He proposes a novel Zeroth-Order Regularized Optimization method, coined ZORO. With a novel approximately sparse gradient assumption and a randomized gradient estimator, his team shows that the theoretical and empirical convergence rate of ZORO is only logarithmically dependent on the problem dimension. Numerical experiments show ZORO outperforms existing methods on both synthetic and real datasets.

Cai is the Paul N. Somerville Endowed Assistant Professor of Statistics and Data Science at UCF. He is also the director of Data Science Lab. Prior to that, he was an assistant adjunct professor at the University of California, Los Angeles. His research interests include machine learning, data science, mathematical optimization and applied harmonic analysis.