University of Miami, Physics Department Colloquium

Date: Monday, Feb 10, 2025
Time: 4:00 pm – 5:00 pm
Location: Wilder Auditorium – Rm 112, Knight Physics Building

Exploring the Unseen Landscape with Quantum Optics

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Abstract

Advanced quantum optical techniques are revolutionizing our ability to observe and understand the universe. Two well-established catalogs of quantum optical states — squeezed states and single-photon states — are critical in this advancement. For squeezed light, I will discuss how squeezing has significantly enhanced the sensitivity of 4km gravitational-wave detectors, the largest quantum metrology experiment in the world. I will also explain the demonstration of quantum correlations in LIGO detectors, showcasing 40kg human-scale macroscopic quantum phenomena. For photon interferometry, I will describe how two-photon states sense Earth's rotation under a non-inertial frame, followed by how entangled photons in an interferometer sensitive to 1E-16 strain can probe the interface between gravitational fields and quantum mechanics. This work also extends to potential applications in dark matter detection. Ultimately, all these achievements pave the way to create unprecedented quantum optical states, offering a novel platform not only for precision quantum measurements to address fundamental questions about our universe, but also for expanding the Hilbert space of quantum information processing.

Biography

Haocun Yu is a Marie-Curie Postdoctoral Fellow at the University of Vienna. She earned her Ph.D. in physics from MIT, where she worked with the LIGO group on quantum optical techniques and phenomena for gravitational-wave detectors. Her research focuses on leveraging quantum techniques and precision sensing methods for exploring new physics. Her contributions have been recognized with prestigious honors, including the MIT Martin Deutsch Award, the APS Carl E. Anderson Dissertation Award, and the Boeing Quantum Creators Prize. She is passionate about continuing interdisciplinary work that advances quantum technologies and addresses intriguing fundamental questions about our world.