IQSE AMO QO Seminar Series

Tuesday, February 1st, 11:30 am ZOOM & IQSE seminar room (MPHY 578)

Pizza will be served for IQSE members at 11:00 am. The talk will start around 11:30 am

Dr. Raphael Pooser

Oak Ridge National Laboratory

21st Century Quantum Sensing

EVENT DETAILS: Quantum sensors are devices that exploit quantum mechanical effects to obtain enhanced sensitivity over their classical counterparts. Sensors that exploit quantum noise reduction, or squeezed light, have seen renewed interest in recent years as a growing number of devices that utilize optical readout – from gravitational wave detection to ultratrace plasmonic sensing at the nanoscale – have approached their absolute limits of detection as defined by the Heisenberg uncertainty principle. At this limit, the noise is dominated by the quantum statistics of light (the shot noise limit when coherent light is used). Simultaneously, many devices, including nanoscale sensors, have reached tolerance thresholds in which power in the readout field can no longer be increased. Beyond these limits, squeezed light is required to further improve sensitivity in these platforms. Here, we present our work geared towards producing practical, ubiquitous quantum sensors that break through the shot noise limit to achieve state of the art sensitivities beyond the capabilities of classical devices. We demonstrate atomic magnetometers, quantum plasmonic imaging, and ultra-trace quantum plasmonic sensors with state-of-the-art quantum noise levels well below the shot noise limit. Further, we will explore the potential of compressive quantum imaging for parallelized plasmonic sensing at the quantum noise limit.

Dr. Pooser is an expert in continuous variable quantum information. He is a Distinguished scientist who currently leads the Quantum Computing and Sensing group within the Quantum Information Science Section at ORNL. His research interests include quantum computing, networking, and sensing. Over the past ten years he developed a quantum sensing program at ORNL from the ground up based on continuous-variable quantum networks. He has been working to demonstrate that continuous variable quantum optics, quantum noise reduction in particular, has important uses in the quantum information field. The deterministic nature of these systems is a strong draw and motivator that leads to practical applications, and this research model uses quantum sensors as a showcase for the technologies that will enable quantum computing. Notable achievements include demonstrations of quantum plasmonic sensors with signal to noise ratios that exceed the classical state of the art, the first demonstrations quantum-enhanced read

out of atomic force microscope cantilevers, and the first practical applications of nonlinear interferometry.

ZOOM information:

https://tamu.zoom.us/j/98156251523?pwd=QVdSdGxtL1UyY0g1L083SU5QR0QrUT09

Meeting ID: 981 5625 1523
Passcode: 297578

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+13462487799,,98156251523# US (Houston)
+16694449171,,98156251523# US