Quantum Science and Technology Mini-Symposium
Room 208 W - Session QS2-TuM

Quantum Foundries, Educational Initiatives, Sensing and Metrology

Moderators: Ekta Bhatia, NY CREATES, **Haozhi Wang**, University of Maryland College Park

11:00am **QS2-TuM-13 NIST on a Chip, Quantum-Based Sensors for Metrology in the Quantum Era**, ***Jay Hendricks***, National Institute of Standards and Technology (NIST) **INVITED**

The re-definition of the SI units enables new ways to realize fundamental units. Quantum-based metrology systems, however exciting, do raise new challenges and several important questions: Can these new realizations enable the size and scale of the realization to be miniaturized to the point where it can be imbedded into everyday products?What will be the role of metrology institutes in the is new ecosystem of metrology and measurement?This talk will begin to explore these important philosophical questions.The technical core of the talk will be a deeper dive into research on measurement methods for pressure, the Fixed Length Optical Cavity (FLOC) and for vacuum the Cold Atom Vacuum Standard (CAVS).What is exciting about many of these new measurement approaches is that they are both primary (relying on fundamental physics), are quantum-based and use photons for the measurement readout which is key for taking advantage of the fast-growing field of photonics.

11:30am **QS2-TuM-15 Characterization and Comparison of Optoelectronic Properties of High-Internal Quality Factor, Superconducting TiN Devices Deposited Using Molecular Beam Epitaxy and Magnetron Sputtering**, ***Elizabeth Pogue***, *Adrian Podpirka, Andrew Bennett-Jackson, James Shackford, Jeff Corgan,* Johns Hopkins Applied Physics Lab*; Thomas Whorisky,* Johns Hopkins University*; Joseph Prestigiacomo,* Naval Research Laboratory*; Austin Ferrenti,* Johns Hopkins University*; D. Scott Katzer, Virginia Wheeler,* Naval Research Laboratory*; Kyle McElroy,* Johns Hopkins Applied Physics Lab

Superconducting nitrides are of interest for a wide variety of quantum computing, quantum sensing, and quantum circuit applications. In contrast to conventional elemental superconductors like Nb and Al, superconducting nitrides are amenable to epitaxy with insulating nitrides, SiC, sapphire, and silicon. Superconducting nitrides also offer substantial tunability in properties like the superconducting gap and degree of crystallinity. This tunability feature also introduces challenges as the deposition conditions of these nitrides impact the performance of and decoherence mechanisms in play for these end-use applications. Here, we compare changes in kinetic inductance and optical properties of TiN resonators made using MBE and sputtered TiN films. We show that devices made from sputtered TiN films exhibit kinetic inductance two orders of magnitude higher than the devices made from MBE-grown TiN films, despite relatively similar IR properties. The MBE-grown TiN resonators exhibit kinetic inductances < 1 pH/sq with RRR >5.5. The analysis approaches needed for extracting kinetic inductance from such well-ordered films, which require more care than films with more disorder, are described. We show limitations of conventional methods used to extract resonator quality factor; when the external quality factor is lower than the internal quality factor, measurement line non-linearities have a pronounced impact on characterization.

11:45am **QS2-TuM-16 Invited Paper**, ***Irfan Siddiqi***, Lawrence Berkeley National Laboratory **INVITED**

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