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Microwave multiplexed readout of transition edge sensors for neutrino detection

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Neutrino detectors have the proven capability to monitor nuclear reactor power levels and fuel consumption by observing the energy spectrum of neutrinos emitted by the reactor. However, conventional neutrino detection techniques require massive detectors that would be difficult to deploy in the field for nuclear monitoring applications. A new detection method, Coherent Elastic Neutrino-Nucleus Scattering, requires significantly smaller target mass—kilograms instead of kilotons. Therefore, a deployable nuclear monitoring system based on coherent neutrino scattering would have significantly lower size, weight, and power requirements than competing systems based on conventional neutrino detection techniques. Coherent scattering was recently demonstrated for high-energy neutrinos from a spallation source. However, detecting the low-energy neutrinos produced in nuclear reactors will require significant improvements in sensor technology.
The Ricochet collaboration aims to perform the first detection of reactor neutrinos via coherent neutrino scattering. Our approach relies on arrays of TES bolometers specifically optimized to measure extremely low recoil energies in the range of 10-50 eV. In this talk, we will describe our efforts at MIT Lincoln Laboratory to develop circuits for microwave multiplexed readout of these highly-sensitive bolometric detectors.

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Authors: Dr WEBER, Steven (MIT Lincoln Laboratory); Dr RYU, Kevin (MIT Lincoln Laboratory); Dr HIRJIBEHEDIN, Cyrus (MIT Lincoln Lab); Dr TROWBRIDGE HEINE, Sarah (Massachusetts Institute of Technology); Prof. OLIVER, William (Massachusetts Institute of Technology); Prof. FORMAGGIO, Joseph (Massachusetts Institute of Technology)

Presenter: Dr WEBER, Steven (MIT Lincoln Laboratory)

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