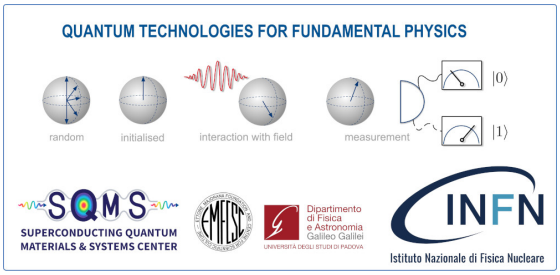

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Novel Materials for High Coherence Superconducting Quantum Devices

Sunday, 3 September 2023 11:35 (15 minutes)

The SQMS Center has launched a systematic investigation to help identify sources of microwave loss and decoherence in superconducting quantum devices, and converge on materials/passivations to mitigate these loss mechanisms. In a Center wide effort, the surface oxides of Nb, singled out to be a significant source of decoherence, is replaced by a passivation layer. A wide range of materials has been explored as the passivation layer to include Al, Ta, and TiN, to name a few. Our results show that the coherence time of transmon qubits is significantly improved for devices on Nb with Ta encapsulation, by a factor of 3 to 5, compared to devices on bare Nb with surface oxide. Our best T1 reaches ~200 us (450 us) for devices fabricated on sapphire (Si) substrates. These results firmly establish the SQMS Center amongst the leading teams capable of fabricating high coherence quantum devices. Superconducting qubits and quantum sensors with reduced decoherence could potentially be useful in the search of weakly coupled particles.

Presenter: BAL, Mustafa (Fermilab)

Session Classification: Superconducting cavities, materials, and quantum technology for detection of weakly-coupled particles