Contribution ID: **18** Type: **Poster**

Quantum Networking with a Metastable Sr+ Qubit

Monday, 25 September 2023 19:30 (2 hours)

The Strontium ion is an ideal candidate for medium-distance quantum networking due to an atomic transition at 1.1 μm, a wavelength compatible with existing fiber optic infrastructure. This transition eliminates the need for lossy photon conversion processes, allowing for direct remote entanglement on the kilometer scale. We report on current progress towards ion-photon entanglement in a Strontium ion trap system, including design and construction of the high numerical aperture imaging system for photon collection. The final qubit states in our photon-generation scheme lie in the $D_{3/2}$ level and differ by $\Delta m_j = 2$. We show results from readout of the metastable state with an extended probabilistic detection method without shelving. Additionally, we discuss work towards building a microwave vortex antenna for directly driving this dipole-forbidden transition.

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Session Classification: Monday Poster