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Interfacing single millimeter wave and optical photons using Rydberg atoms as mediators.[1] AZIZA SULEYMANZADE, MARK STONE, AISHWARYA KUMAR, LAVANYA TANEJA, JASMINE KALIA, DAVID SCHUSTER, JONATHAN SIMON, University of Chicago — In this talk, I introduce our hybrid quantum system for entangling and inter-converting single millimeter waves (mm-waves) and optical photons. In our apparatus, a cloud of cold Rubidium 85 atoms is lowered into a hybrid optical Fabry-Perot and 3D superconducting mm-wave cavity, where it simultaneously interacts with both optical and mm-wave photons via Electromagnetically Induced Transparency (EIT). One of the strengths of our approach is a high cooperativity of 22000 between a single mm-wave photon and a Rydberg atom, enabling a strong nonlinearity. Aside from providing the experimental details of our setup, I will motivate our use of mm-wave photons both as a promising interlink band for hybrid cavity and circuit QED systems, and as a stand alone platform for quantum devices at high temperatures.

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