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Quantum Sensors and the Chu Limit for Classical Communication DAVID MEYER, University of Maryland, KEVIN COX, PAUL KUNZ, U.S. Army Research Laboratory — The fastest classical communication rates are achieved using antennas with high sensitivity and low Q-factor, which provides the largest bandwidth. The Chu Limit establishes that the minimum Q for a classical antenna is proportional to the cube of the wavelength of the electric field and inversely proportional to the volume of the conductor. Here we investigate this limit with respect to a quantum sensor, Rydberg atoms in a thermal vapor, which has been shown to be ideally suited for measuring electric fields ranging from 100 MHz to 1 THz. We present a derivation of the Q of a Rydberg atom receiver, via direct and non-demolition measurement, which shows a more favorable scaling than comparable classical antennas of similar size, suggesting the Rydberg atom receiver could enable faster communication rates than that currently available.

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