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Cavity-Aided Single Atom Detection on an Atom Chip IGOR TEPER, YU-JU LIN, VLADAN VULETIC, MIT-Harvard Center for Ultracold Atoms, MIT, Cambridge, MA 02139 — We will present the results in detecting and counting small numbers of rubidium atoms, down to one atom, in a microscopic magnetic trap. We employ a 2.5 cm long, near-confocal cavity with a finesse of 8600 mounted on the atom chip that generates the microtrap. Both fluorescence and absorption techniques are used for the detection. In the fluorescence scheme, 2.0(2) photons per atom are collected, which achieves a quantum efficiency of 75% for single atom detection with a probability of 7% of false counting due to background photons, while the attenuation of transmission through the cavity is 2.0(3)% per atom. The cavity can also potentially be used for spin squeezing by measuring the atom-induced cavity frequency shift, and we expect that 20dB of squeezing can be achieved with N= 5x10^5 atoms. Spin squeezing would allow for an atomic clock operated below the standard quantum limit (shot noise limit).

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