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Atom number squeezing and Rydberg level shifts near a magnetic film atom chip ATREJU TAUSCHINSKY, CASPAR OCKELOEN, RUTGER THIJSSEN, BEN VAN LINDEN VAN DEN HEUVELL, SHANNON WHITLOCK, ROBERT SPREEUW, Univ. of Amsterdam — We have produced a two-dimensional lattice of microscopic traps above a magnetic-film atom chip. A few hundred optically resolved microtraps, each holding tens to a few hundred ^{87}Rb atoms, are cooled to quantum degeneracy in parallel. For any given site in the lattice we observe squeezing of the shot-to-shot atom number fluctuations to below the Poissonian level, due to strong three-body loss in these tightly confining microtraps. We aim to perform quantum information studies in mesoscopic ensembles in this lattice, using the dipole blockade of Rydberg atoms to mediate switchable, long-range interaction. In order to characterize the influence of the chip surface we are now using electromagnetically induced transparency (EIT) in a three-level ladder configuration. This allows us to study level shifts and broadenings of the Rydberg states in the proximity of the surface. Preliminary results show MHz level shifts at typical distances of $\sim$50 μm, and a strong dependence on the distance to the surface and the principal quantum number. The shifts are most likely caused by electric fields originating in the surface. Our lattice of mesoscopic ensembles has bright prospects for being developed as a scalable platform for quantum information science with neutral atoms.

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