Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Rydberg Interactions On An Atom Chip ROBERT SPREEUW, VANESSA LEUNG, ATREJU TAUSCHINSKY, BEN VAN LINDEN VAN DEN HEUVELL, Van der Waals-Zeeman Instituut, Universiteit van Amsterdam — We report on our experiments aimed at developing a scalable quantum information platform based on a two-dimensional lattice of microscopic traps on a magnetic-film atom chip. Previously we have shown that a few hundred microtraps, each holding tens to several hundred ^{87}Rb atoms, can be individually resolved, optically addressed, and spatially manipulated as a shift register [1]. Our current goal is to use the dipole blockade of Rydberg atoms to mediate switchable, long-range interaction between mesoscopic ensembles on the lattice. Through spectroscopic studies with electromagnetically induced transparency (EIT), we characterize the level shifts and broadenings of the Rydberg states in the proximity of the surface [2]. Our results open the way to studies of dipolar physics, collective excitations, quantum metrology, and quantum information processing involving interacting Rydberg excited atoms on atom chips. [1] Whitlock, S., R. Gerritsma, T. Fernholz, and R.J.C. Spreeuw, *Two-dimensional array of micro-traps with atomic shift register on a chip*, New Journal of Physics **11**, 023021 (2009) [2] Tauschinsky, A., R. M. T. Thijssen, S. Whitlock, H. B. van Linden van den Heuvell, and R. J. C. Spreeuw, *Spatially resolved excitation of Rydberg atoms and surface effects on an atom chip*, Phys. Rev. A **81**, 063411 (2010)

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Date submitted: 01 Feb 2011 Electronic form version 1.4