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Spatially resolved observation of dipole-dipole interaction between Rydberg atoms CAROLIJN VAN DITZHUIJZEN, Van der Waals-Zeeman Instituut, University of Amsterdam, FEMIUS KOENDERINK, FOM-Institute for atomic and molecular physics, Amsterdam, ATREJU TAUSCHINSKY, BART NOORDAM, BEN VAN LINDEN VAN DEN HEUVELL, Van der Waals-Zeeman Instituut, University of Amsterdam — We have observed resonant energy transfer between cold Rydberg atoms in separate volumes. Two pulsed laser beams are focused in a ^{85}Rb MOT, with waists of ~ 10 μm. In one laser focus ~ 10 atoms are excited to the 49s state and in the other ~ 60 atoms are excited to the 41d state. At a field of 0.4 V/cm a resonant dipole-dipole coupling occurs with a wavelength of 1 cm: $41\mathrm{d} + 49\mathrm{s} \rightarrow 42\mathrm{p} + 49\mathrm{p}$. We have measured the production of the 49p state as a function of laser focus separation (0 - 80 μm) and interaction time (0 - 50 μs). The procedure can be understood as writing a 0 bit (49s) in volume A and a 1 bit (41d) in volume B. The bit in A goes from 0 to 1 (49p) and the bit in B from 1 to 0 (42p), due to the dipole-dipole energy transfer from B to A.

Carolijn van Ditzhuijzen
Van der Waals-Zeeman Instituut, University of Amsterdam

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