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Trapping of Ultracold Atoms in a 10 μm-Period Permanent Magnetic Lattice RUSSELL MCLEAN, SMITHA JOSE, PRINCE SURENDRAN, LESZEK KRZEMIEN, SHANNON WHITLOCK, MANDIP SINGH, ANDREI SIDOROV, PETER HANNAFORD, Centre for Atom Optics and Ultrafast Spectroscopy, Swinburne University of Technology, Australia — We report the trapping of cold ^{87}Rb atoms in a 10 μm-period 1D magnetic lattice constructed from a TbGdFeCo magnetic microstructure on an atom chip. About 3×10^5 atoms, optically pumped into the F=1, m_F = -1 ground state to reduce losses due to three body recombination, are loaded into $\sim$100 lattice sites at $\sim$10 μm below the chip surface with a trap lifetime of $\sim$12 s. Individual clouds in the lattice have been spatially resolved with in-situ absorption imaging. RF spectroscopy measurements at a specific lattice site indicate an atom temperature of 1-2 μK, close to the calculated BEC transition temperature of 1.5 μK for 2000 atoms. Besides offering potential technical advantages over optical lattices, and the ability to be mounted on an atom chip [1], magnetic lattices can potentially be tailored to arbitrary geometries such as triangular-based and honeycomb lattices [2]. In future we plan to seek a clear signature of the BEC transition in the multiple lattice traps; study decoherence times for a two-component ultracold gas close to the chip surface using by Ramsey interferometry; and implement a 2D magnetic lattice, with periods down to $\sim$1 μm and tailored geometries, using state-of-the-art magnetic microstructure technology, with a view to perform quantum tunneling experiments.

[1] M. Singh et al J. Phys. B **41**, 065301 (2008).
[2] R. Schmied et al *New J. Phys.* **12**, 103029 (2010).

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