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Loading and Manipulating Atoms on a Chip.[1] DAVID AVELINE, JPL/USC, ROBERT THOMPSON, JPL, NATHAN LUNDBLAD, Caltech, LUTE MALEKI, JPL — We describe a method of efficiently loading and manipulating neutral atoms in atom chip traps. Cooled 87Rb from a MOT is transported via coil-based magnetic traps into chip-based wire traps and precisely directed in wire-guides. Our loading method begins with the collection of a MOT located 4 cm away from the chip's trapping region. At this distance, a conventional MOT of six beams can be made without obstruction from the chip and its mounting structure. The MOT's anti-Helmholtz coils are aligned along an axis normal to the chip surface, and this pair of coils also serves as a magnetic quadrupole trap. A second pair of anti-Helmholtz coils is centered on the chip's trapping region. Trading currents between the two coils smoothly translates a magnetic trap over to the chip region. Finally, the atoms transfer to a U-shaped wire on the chip surface. We have achieved near unity transfer efficiency. Once in the U-trap, the atoms can transfer into a Z-trap and single wire guides. We report on investigations of manipulating atoms with external gradients, and splitting into reflected and transmitted components as they traverse a potential barrier. We also discuss results of studies to precisely control the output coupling of the atoms into the guide.

[1]This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology.

David Aveline
JPL/USC

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