Abstract Submitted
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Verifying the Reif model of MOT loading:Trap depth and density dependence[1] JAMES BOOTH, British Columbia Institute of Technology, MAGNUS HAW, NATHAN EVETTS, WILL GUNTON, JANELLE VAN DONGEN, KIRK MADISON, University of British Columbia — We have studied the loading of rubidium atoms into a magneto-optical trap (MOT) with the aim of verifying a long-standing conjecture referred to as the Reif model. This model predicts that the loading rate should be proportional to the escape velocity of atoms from the trap to the fourth power, or equivalently, to the trap depth squared, and is directly proportional to the background rubidium atom density. The first prediction was confirmed by comparing the MOT loading rates to trap depths deduced from optical excitation of trapped atoms to a repulsive molecular potential. The rubidium density dependence was demonstrated by comparing the elastic collision-induced loss rate of atoms from a magnetic trap (MT) and the loading rate of a MOT: since the MT loss rate is proportional to the background density, the linear correlation to the MOT loading rate verified the Reif model. As a consequence of these findings, i) we have shown that the loading rates of different MOTs can be used as a convenient measure of their relative trap depths, and ii) we have experimentally determined the relationship between the capture and escape velocities in the MOTs studied (ranging in depth from 0.5 K to 1.8 K) to be $v_c = 1.29(0.12)v_e$.

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