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**Direct Measurement of Excited State Fractions in a MOT** M.H. SHAH, M.L. TRACHY, G. VESHAPIDZE, J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506, H.A. CAMP, Institute for Defense Analyses, Alexandria, VA 22311-1882, M.A. GEARBA, Dept. of Physics & Astronomy, Univ. of Southern Mississippi, Hattiesburg, MS, 39406., H. NGUYENC, Dept. of Physics & Astronomy, Univ. of Wisconsin – Stevens Point, Stevens Point, WI 55481., B.D DEPAOLA, J. R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, KS 66506 — Accurate measurement of excited state fraction is critical in measurements of photo-ionization and electron impact cross sections, and the rapidly growing field of cold and ultra-cold collision cross section measurements. Many groups have reported that a large source of uncertainty in their results comes from the fluorescence-based measurement of the MOT excited state fraction. In this work we report the results of directly measured in-MOT excited state fractions as a function of trapping laser intensity and detuning. The experimental approach is based on the MOTRIMS methodology. Here instead of looking at the fluorescence, charge transfer to a beam of 7 keV  $\text{Na}^+$  is used as a probe. The results are compared with theoretical models.

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