Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

A quantum gas of ground state molecules in an optical lattice JOHANN DANZL, MANFRED MARK, ELMAR HALLER, MATTIAS GUSTAVSSON, RUSSELL HART, HANNS-CHRISTOPH NÄGERL, University of Innsbruck — Ultracold samples of molecules are ideally suited for fundamental studies in physics and chemistry. For many of the proposed experiments full molecular state control and high phase space densities are needed. We create a dense quantum gas of ground state Cs_2 molecules trapped at the wells of a 3D optical lattice, i.e. a molecular Mott-insulator-like state with ground state molecules with vibrational quantum number $v = 0$. We first efficiently produce weakly bound molecules with $v \approx 155$ on a Feshbach resonance out of an atomic Mott-insulator state that is obtained from a Bose-Einstein condensate (BEC) of Cs atoms. These molecules are then (coherently) transferred to the ground state by two sequential two-photon STIRAP processes via the intermediate vibrational level $v \approx 73$ [1]. The molecule production efficiency and the single-step STIRAP transfer efficiency reach 50% and 80%, respectively. We discuss the stability of the system and our progress towards the creation of a BEC of ground state molecules, which is expected to form when the molecular Mott-like state is "melted" upon lowering the lattice depth and releasing the molecules from the wells into a large volume trap.

[1]J. G. Danzl, E. Haller, M. Gustavsson, M. Mark, R. Hart, N. Bouloufa, O. Dulieu, H. Ritsch, H.-C. Nägerl, Science **321**, 1062 (2008).

Russell Hart
University of Innsbruck

Date submitted: 27 Jan 2009 Electronic form version 1.4