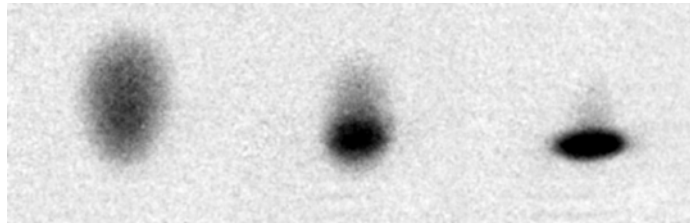


## Observation of Bose-Einstein Condensation of Molecules

Molecular condensates could lead to a host of new scientific explorations. These include quantum gases with anisotropic dipolar interactions, tests of fundamental symmetries such as the search for a permanent electric dipole moment, study of rotational and vibrational energy transfer processes, and coherent chemistry, where reactants and products are in coherent quantum superposition states. In November 2003, observation or indirect evidence for Bose-Einstein condensation of molecules was reported by three groups [1-3].

We observed BEC of lithium molecules. When a spin mixture of fermionic  ${}^6\text{Li}$  atoms was evaporatively cooled in an optical dipole trap near a Feshbach resonance, the atomic gas was converted into  ${}^6\text{Li}$  molecules. Below 600 nK, a Bose-Einstein condensate of up to 900,000 molecules was identified by the sudden onset of a bimodal density distribution. This condensate realizes the limit of tightly bound fermion pairs in the crossover between BCS superfluidity and Bose-Einstein condensation.



Observation of Bose-Einstein condensation in a molecular gas. Shown are three single-shot absorption images after 6 ms of ballistic expansion for progressively lower temperatures (left to right). The appearance of a dark spot marks the onset of BEC. The field of view for each image is  $1.4 \times 1.4 \text{ mm}^2$ .

1. M. Greiner, C.A. Regal, and D.S. Jin, *Emergence of a molecular Bose-Einstein condensate from a Fermi gas*, Nature **426**, 537 (2003).
2. M.W. Zwierlein, C.A. Stan, C.H. Schunck, S.M.F. Raupach, S. Gupta, Z. Hadzibabic, and W. Ketterle, *Observation of Bose-Einstein Condensation of Molecules*, Phys. Rev. Lett. **91**, 250401 (2003).
3. S. Jochim, M. Bartenstein, A. Altmeyer, G. Hendl, S. Riedl, C. Chin, J. Hecker Denschlag, and R. Grimm, *Bose-Einstein Condensation of Molecules*, Science **302**, 2101 (2003).