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Coherent Molecular Optics using Sodium Dimers DANIEL MILLER, KAIWEN XU, JAMIL ABO-SHAEER, JITKEE CHIN, YINGMEI LIU, WOLFGANG KETTERLE — Coherent molecular optics is performed using two-photon Bragg scattering. Molecules were produced by sweeping an atomic Bose-Einstein condensate through a Feshbach resonance. The spectral width of the molecular Bragg resonance corresponded to an instantaneous temperature of 20 nK, indicating that atomic coherence was transferred directly to the molecules. An autocorrelating interference technique was used to observe the quadratic spatial dependence of the phase of an expanding molecular cloud. Finally, atoms initially prepared in two momentum states were observed to cross-pair with one another, forming molecules in a third momentum state. This process is analogous to sum-frequency generation in optics.

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