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**Controlled state-to-state atom-exchange reaction in ultracold atom-dimer mixture** HUAN YANG, Univ of Sci & Tech of China, UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA TEAM[1] — Ultracold molecules offer remarkable opportunities to study chemical reactions at nearly zero temperature. Although significant progresses have been achieved in exploring ultracold bimolecular reactions, the investigations are usually limited to measurements of the overall loss rates of the reactants. Detection of the reaction products will shed new light on understanding the reaction mechanism and provide a unique opportunity to study the state-to-state reaction dynamics. Here we report on the direct observation of an exoergic atom-exchange reaction in an ultracold atom-dimer mixture. Both the atom and molecule products are observed and the quantum states are characterized. By changing the magnetic field, the reaction can be switched on or off, and the reaction rate can be controlled. The reaction is efficient and we have measured a state-to-state reaction rate of up to $7.2(7)10^{-10}$ $cm^3/s$ from the time evolution of the reactants and products. The atom-exchange reaction observed is also an effective spin-exchange interaction between the Feshbach molecules and the fermionic atoms and may be exploited to implement quantum simulations of the Kondo effect with ultracold atoms and molecules.

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