

Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Lattice-induced rapid formation of spin singlets in spin-1 spinor condensates TAO TANG, LICHAO ZHAO, ZIHE CHEN, YINGMEI LIU, Oklahoma State University — We experimentally demonstrate that combining a spinor Bose-Einstein condensate with cubic optical lattices significantly relaxes three strict constraints and enables a rapid generation of spin singlets using ultracold spin-1 atoms. Our observations confirm that spin singlets of spin-1 atoms are brought into experimentally accessible regions by two key lattice-modified parameters, which are the lattice-enhanced interatomic interactions and substantially reduced atom number in individual lattice sites. About 80 percent of atoms in the lattice-confined spin-1 spinor condensate are found to form spin singlets, after the atoms cross first-order superfluid to Mott-insulator phase transitions in an ideal lattice ramp sequence. In addition, we develop a phenomenological model that well describes our observations without adjustable parameters.

Tao Tang
Oklahoma State University

Date submitted: 25 Jan 2018

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