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Discovery of a New Quantum Dimer Magnet in a Strongly Spin-Orbit Coupled Material[1] GAVIN HESTER, HARI NAIR, TIM REEDER, Colorado State University, JEFF QUILLIAM, University of Sherbrooke, JAMIE NEILSON, Colorado State University, GABRIELLE SALA, Oak Ridge National Laboratory, KATE ROSS, Colorado State University — Various novel phases of matter have been discovered in the search for a quantum spin liquid and research on high-temperature superconductivity. One such state is the quantum dimer magnet, which consists of entangled electrons forming spin singlets in a solid. A phenomenon occurs in these materials called Bose-Einstein condensation (BEC), most famously observed in ultracold gases, that is bounded by lower and upper critical fields. Many compounds based on 3d magnetic cations have been found that exhibit a quantum dimer state with BEC. We have found a new realization of this state in $Yb_2Si_2O_7$, which is of interest due to its high spin-orbit coupling, which leads to anisotropic exchange. Specific heat data shows a field-dependent Schottky-like anomaly peaked near 1 K and a low temperature transition to the BEC phase that appears at the first critical field. Single crystal inelastic neutron scattering was performed using the Cold Neutron Chopper Spectrometer at Oak Ridge National Laboratory. Changes in elastic and inelastic data occur at the same critical fields as specific heat measurements. However, these critical fields are much smaller than observed in known systems due to magnetism arising from 4f electrons, giving easier access to the full field vs. temperature phase diagram.

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