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Observation of Spin-Spin Fermion-Mediated Interactions between Ultracold Bosons HAGAI EDRI, BOAZ RAZ, NOAM MATZLIAH, NIR DAVIDSON, ROEE OZERI, Weizmann Institute of Science — In a mixture of a condensed Bose gas (BEC) and spin polarized degenerate Fermi gas (DFG), fermions can mediate interaction between bosons, leading to an effective long-range interaction between the bosons, analogous to Ruderman–Kittel–Kasuya–Yosida (RKKY) interaction in solids. We used Ramsey spectroscopy to measure frequency shifts of the bosons’ hyperfine levels due to interactions with fermions. We isolated the frequency shift related to mediated interaction from shifts caused by direct collision of fermions and bosons. Our measurement showed an increase of spin-spin interaction between bosons by a factor of $\eta = 1.43 \pm 0.06^{\text{stat}} \pm 0.17^{\text{sys}}$ in the presence of the DFG, providing a clear evidence of spin-spin fermion mediated interaction. This interaction can be tuned with a boson-fermion Feshbach resonance. Fermion mediated interactions can potentially give rise to interesting new magnetic phases and extend the Bose-Hubbard model when the atoms are placed in an optical lattice.

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