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Testing the limit of infinite-range interactions mediated by optical nanofibers[1] HYUN GYUNG LEE, Korea University, HYOK SANG HAN, Joint Quantum Institute, University of Maryland and NIST, KANUPRIYA SINHA, F.K. FATEMI, Army Research Laboratory, S.L. ROLSTON, Joint Quantum Institute, University of Maryland and NIST — Electromagnetic fields confined to waveguides enables effectively infinite-range interactions between macroscopically separated quantum objects. An optical nanofiber(ONF) is an excellent platform to study long-distance quantum interactions between atoms near the fiber. In previous work, an ONF mediated super- and sub-radiance between atoms that were separated by a fraction of 1 mm[1]. Still, the practical limit of infinite-range interactions remains to be tested and interesting crossover is expected around the range corresponding to the atom's optical decay lifetime, where non-Markovian effects become important. In this work, we use a pair of ONFs placed in the same cloud of magneto-optically trapped atoms that are connected via conventional single-mode fiber outside the vacuum chamber. The benefit of this configuration is two-fold: (i) We can vary the interaction range between the two ONF systems by choosing different lengths of the connecting fiber outside the chamber; (ii) The spatial proximity between the two ONFs minimizes the differential perturbation due to the inhomogeneity of both driving and ambient field. We will present details of the experimental implementation as well as current progress. [1] Solano, P. et al, Nat. Commun. 8, 1857 (2017).

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