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Hybrid quantum interface for quantum transduction between mechanics and spins JIALUN LUO, HIL FUNG HARRY CHEUNG, YOGESH S PATIL, MUKUND VENGALATTORE, Cornell University — Diverse quantum systems are currently being developed for various aspects of quantum information processing, metrology and communication. A robust, coherent interface between such different systems is crucial to realize a quantum network. Here, we report progress on the quantum transduction between a mechanical resonator and quantum spins in a hybrid quantum system that optically interfaces a membrane-in-the-middle optomechanical cavity with an ultracold spin ensemble. Such an implementation allows for a remote coupling between the two modular quantum systems. For system parameters realized in our laboratory, we show that the membrane resonator displacement can be transduced into spin excitations even at the level of the resonator zero point motion. As shown in recent theoretical work, this experimental demonstration of a coherent quantum interface is a powerful ingredient that can enable quantum state preparation, nonclassical state transfer and backaction-evading measurements [1,2]. [1] F. Bariani, et al., Phys. Rev. A 92, 043817 (2015) [2] S. K. Steinke, et al., Phys Rev. A 84, 023841 (2011)

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