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Spin-mediated optomechanical cooling of a mechanical resonator SRIVATSAN CHAKRAM, YOGESH PATIL, Cornell University, STEVEN STEINKE, FRANCESCO BARIANI, PIERRE MEYSTRE, University of Arizona, MUKUND VENGALATTORE, Cornell University — We report recent results on using an ultracold gas of atoms to sympathetically cool a mesoscopic mechanical resonator. The optomechanical response of a 'membrane in the middle' system is tuned by controlling the dispersion of the ultracold gas. This coupling between the mechanical motion of the resonator and the quantum spins of the atomic gas realizes a hybrid optomechanical system that is effectively in the resolved sideband regime, thereby enhancing the cooling of the resonator. We also report progress towards using the ultracold gas for enhanced measurement and control of the mechanical system.

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