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Supercooling of Atoms in an Optical Resonator MINGHUI XU, JILA, SIMON JÄGER, STEFAN SCHÜTZ, Theoretische Physik, Universität des Saarlandes, Germany, JOHN COOPER, JILA, GIOVANNA MORIGI, Theoretische Physik, Universität des Saarlandes, Germany, MURRAY HOLLAND, JILA
— We investigate laser cooling of an ensemble of atoms in an optical cavity. We demonstrate that when atomic dipoles are synchronized in the regime of steady-state superradiance, the motion of the atoms may be subject to a giant frictional force leading to potentially very low temperatures. The ultimate temperature limits are determined by a modified atomic linewidth, which can be orders of magnitude smaller than the cavity linewidth. The cooling rate is enhanced by the superradiant emission into the cavity mode allowing reasonable cooling rates even for dipolar transitions with ultranarrow linewidth.

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