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Doppler cooling to the Quantum limit

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(Submitted on 12 Jul 2011 (v1), last revised 16 Dec 2011 (this version, v2))

Doppler cooling on a narrow transition is limited by the noise of single scattering events. It shows novel features, which are in sharp contrast with cooling on a broad transition, such as a non-Gaussian momentum distribution, and divergence of its mean square value close to the resonance. We have observed those features using 1D cooling on an intercombination transition in strontium, and compared the measurements with theoretical predictions and Monte Carlo simulations. We also find that for a very narrow transition, cooling can be improved using a dipole trap, where the clock shift is canceled.

Comments:	DOI: 10.1103/PhysRevLett.107.243002
Subjects:	**Atomic Physics (physics.atom-ph)**
Cite as:	**arXiv:1107.2313 [physics.atom-ph]**
	(or **arXiv:1107.2313v2 [physics.atom-ph]** for this version)

Submission history

From: David Wilkowski [view email]
[v1] Tue, 12 Jul 2011 14:57:13 GMT (658kb)
[v2] Fri, 16 Dec 2011 07:45:29 GMT (660kb)

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