Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Enhancement of Electromagnetically Induced Transparency Cooling by an Optical Cavity[1] WEI WU, JIE ZHANG, SHUO ZHANG, BAO-QUAN OU, PING-XING CHEN, National University of Defense Technology — One of the most popular methods for cooling trapped ions to ground state is sideband cooling. However, carrier and blue sideband still exist, which are the obstacles for reaching lower phonon number. EIT cooling cancels the carrier transition and suppressed blue sideband transition to some extent, blue sideband transition still exists. To further suppress the blue sideband transition and improve EIT cooling, Introducing an optical cavity provides us a promising way to enhance the EIT cooling and reach lower phonon number for a trapped ion. A Λ-configuration ion with mass M is trapped in a Paul trap, we consider the situation that the radial confinement is much stronger than that of the axial direction, only one dimensional movement along the axis should be concerned. If we set the dutuning properly, EIT effect occurs, canceling the carrier transition, while the heating effect from blue sideband transition can be suppressed by quantum interference between the laser and cavity. Analytical calculation shows that cooling limit of this new scheme is

$$\langle n \rangle_{st} = \frac{1}{\mathcal{C}}, \tag{1}$$

Numerical simulation shows that the standard EIT cooling is enhanced with the help of the high finesse cavity.

[1]National Natural Science Foundation of China (Grant Nos 11304387 and 61205108)

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Date submitted: 22 Dec 2014 Electronic form version 1.4