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Cooling and trapping of Single Yb atom in a high-finesse optical cavity YUJIRO ETO, ATSUSHI NOGUCHI, PENG ZHANG, MASAHITO UEDA, MIKIO KOZUMA, TOKYO INSTITUTE OF TECHNOLOGY TEAM, ERATO MACROSCOPIC QUANTUM CONTROL PROJECT, JST COLLABORATION, UNIVERSITY OF TOKYO COLLABORATION — Nuclear spin of $^1S_0$ ground state of Yb atom is a promising candidate of quantum bit, because the coherence time is much longer than that for the electric spin and its information can be transferred to flying qubit (photon) through the hyperfine interaction. Recently projective measurements were performed on single nuclear spin of Yb atom by using such a hyperfine interaction and also the cavity QED technique.[1] However, the operation time for the qubit was limited to an extremely short time ($\sim$100us) because freely falling atoms was used for the experiment. While there exists an efficient cooling method using a cavity-induced Purcell effect, experiments have been demonstrated so far only for alkali atoms such as Rb and Cs. Here we report the first implementation of the cavity-assisted cooling for single Yb atom in a high-finesse optical cavity. The trapping time of a few second has been achieved and clear quantum jump was monitored, where the cooling was performed using the $^1S_0-^3P_1$ intercombination transition (556 nm).

[1]Takeuchi *et al.*, arXiv:0907.0336.

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