Abstract Submitted
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An ytterbium quantum gas microscope with narrow-line laser cooling RYUTA YAMAMOTO, JUN KOBAYASHI, KOHEI KATO, TAKUMA KUNO, YUTO SAKURA, YOSHIRO TAKAHASHI, Kyoto University — Single-site resolved imaging of alkali metal in a two-dimensional optical lattice (Quantum Gas Microscope, QGM) is realized [1] and enables us to directly observe the in-trap atom distribution and study quantum dynamics with single-site resolution [2]. It is important to extend the applicability of a QGM technique to two-electron atoms such as alkaline-earth metal and ytterbium (Yb) atoms because it opens up many unique possibilities for the quantum simulation and quantum information research. Differently from the first report on single-site resolved imaging of Yb atoms with a long lattice constant 544 nm and a short lifetime of 62 μs without cooling [3], we successfully realize the QGM of Yb atoms with a short lattice constant 266 nm, in which we achieve a high-resolution imaging with a low temperature of 7.4 μK and a long lifetime of 7 s by narrow-line laser cooling [4]. The high detection fidelity of 87(2)% is achieved in our method. In addition, we are developing a different mode of QGM for Yb atoms. [1] W. S. Bakr et al., Nature 455, 204 (2009), J. F. Sherson et al., Nature 467, 68 (2010) [2] T. Fukuhara et al., Nat. Phys. 9, 235 (2013) [3] M. Miranda et al., PRA 91, 063414 (2015) [4] R. Yamamoto et al., arXiv:1509.03233 (to appear in NJP)

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