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Quantum Simulation of the Majorana Equation with a Trapped Ion XIANG ZHANG, SHEN YANGCHAO, JUNHUA ZHANG, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing, China, JORGE CASANOVA, LUCAS LAMATA, ENRIQUE SOLANO, Department of Physical Chemistry, University of the Basque Country UPV/EHU, Bilbao, Spain, MAN-HONG YUNG, JINGNING ZHANG, KIHWAN KIM, Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing, China — We report on the experimental quantum simulation of symmetry operations such as parity, charge conjugation and time reversal with a trapped ion [1]. In particular, we focus on the realization of anti-unitary operation including complex conjugate as well as time reversal operation in the context of Majorana Equation. It is still unsettled whether a particle described by Majorana equation would exist in nature. Generally, quantum operation is unitary and it is considered to be impossible to implement anti-unitary operation in quantum system. We experimentally study the interesting various phenomena in Majorana equation with a single $^{171}Yb^{+}$ ion based on the proposal of Ref [1]. Quantum simulation may eventually provide a solution to a certain complex problem that is intractable with classical computation. In our study, we explore the other aspect of quantum simulation, where it brings pure theoretical or imaginary concepts to the table top experiment. This work was supported in part by the National Basic Research Program of China Grant 2011CBA00300, 2011CBA00301, the National Natural Science Foundation of China Grant 61033001, 61061130540. KK acknowledge the support from the recruitment program of global youth experts. [1] J. Casanova, et al., Phys. Rev. X, 1, 021018 (2011)

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