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Digital and analog simulation of para-particles[1] CINTHIA HUERTA ALDERETE, Instituto Nacional de Astrofisica, Optica y Electronica (INAOE) and Joint Quantum Institute, University of Maryland, NORBERT LINKE, Joint Quantum Institute, University of Maryland, BLAS MANUEL RODRGUEZ LARA, Tecnologico de Monterrey (ITESM) and Instituto Nacional de Astrofisica, Optica y Electronica (INAOE), NHUNG H. NGUYEN, DAIWEI ZHU, Joint Quantum Institute, University of Maryland — A para-oscillator is a parity-deformed harmonic oscillator characterized by an order parameter. This generalizes the standard Fermi-Dirac and Bose-Einstein statistics associated with fermions and bosons to para-particles. We realize a method for simulating and characterizing these alternative particles using a trapped ion experiment. The combination of the Jaynes-Cummings and anti-Jaynes Cummings dynamics present in a trapped ion coupled to multiple modes of motion simultaneously allows us to recover effective Hamiltonians which create a system analogous to para-Fermi or para-Bose oscillators. Trapped ions are a versatile quantum simulator and a main contender for a universal circuit model quantum computer. We use both of these flavors in this project, simulating para-Bosons digitally using Trotterization and para-Fermions directly by tailoring the native ion-mode couplings. We discuss the mapping steps and the latest experimental results.

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