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The single-atom box: bosonic staircase and effects of parity CHRISTOPH BRUDER, Department of Physics, University of Basel, 4056 Basel, Switzerland, D.V. AVERIN, T. BERGEMAN, Department of Physics and Astronomy, SUNY, Stony Brook, NY 11794-3800 University of Stony Brook, P.R. HOSUR, Department of Physics, Indian Institute of Technology Bombay, Mumbai 400076, India — We have developed [1] a theory of a Josephson junction formed by two tunnel-coupled Bose-Einstein condensates in a double-well potential in the regime of strong atom-atom interaction for an arbitrary total number N of bosons in the condensates. The tunnel resonances in the junction are shown to be periodically spaced by the interaction energy, forming a single-atom staircase sensitive to the parity of N even for large N. One of the manifestations of the staircase structure is the periodic modulation with the bias energy of the visibility of the interference pattern in lattices of junctions. A different, e.g. fermionic, additional particle in the junction leads to non-trivial modifications of the staircase, that can be experimentally observed in the visibility of the interference pattern. [1] D.V. Averin, T. Bergeman, P.R. Hosur, and C. Bruder, Phys. Rev. A **78**, 031601(R) (2008).

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