Inhomogeneous Mott phases of bosons in optical lattices" COURTNEY LANNERT, Department of Physics, Wellesley College, 106 Central Street, Wellesley, MA 02481, BRIAN DEMARCO, SMITHA VISHVESHWARA, TZUCHIEH WEI, Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, IL 61801 — The feasibility of creating a spatially-inhomogeneous phase of neutral bosonic atoms (such as Rubidium) in which multiple Mott-insulating states coexist in a shell structure is discussed and analyzed. In the set-up of trapped, tightly confined bosons in an optical lattice, we derive the conditions on experimental parameters, such as number of bosons and the curvature of the trapping potential, for creating an onion-like structure of any prescribed number of Mott shells with different occupation numbers. We discuss the stability of such a structure with an eye toward experimental conditions necessary for measuring the structure with spectroscopic probes. The analyses ought to give a controlled means of achieving the Mott groundstate observed in previous experiments, and give some constraints for how successfully these states can be employed for quantum computing.

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