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Ring-Shaped Lattices as Quantum Optics Simulators[1] CAELAN BROOKS, ALLISON BRATTLEY, Kutztown University of Pennsylvania, MICHAL KOLAR, Palacky University, KUNAL DAS, Kutztown University of Pennsylvania — Ultracold atoms confined to a ring-shaped trap can have effects of the non-trivial topology manifest through the periodic boundary condition, creating the analog of de Broglies model of stationary electronic orbits in a potentially macroscopic quantum state. Introduction of an azimuthal lattice structure serves to couple the allowed modes just as a laser field couples the electronic states. Thus cold atoms in a ring lattice can serve as a comprehensive quantum optics simulator with some advantages such as, strong nonlinearity can be naturally induced, and the modes in a ring exist as extended states in real space allowing new opportunities for manipulation and visualization. We examine the behavior of such a system as function of relevant parameters, comparing and contrasting with counterparts in electronic states within atoms interacting with light fields.

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