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Deconstruction of excitations in atomtronic systems using phase reference[1] B. COHELEACH, M. EDWARDS, Georgia Southern Univ, C.W. CLARK, Joint Quantum Institute — Laboratory atomtronic systems consisting of a Bose–Einstein–condensed gas with strong horizontal confinement and arbitrary planar potential, such as a ring–plus–disk, are now possible.[2] Perturbing the ring part (e.g., by stirring) can produce excitations such as vortices and solitons. Each excitation uniquely modifies the local condensate phase and these modifications can be probed by overlapping the ring with the unperturbed disk via condensate release. The resulting interference pattern contains signatures of the excitations present at release time. Using the Gross–Pitaevskii equation, we studied whether this interference pattern can be used to determine what excitations were present at release time. We created individual excitations in a ring–plus–disk condensate, released it to see the interference pattern of individual excitations, and created a compendium of these patterns. We also studied whether the individual patterns can be superposed and tested the deconstruction procedure by analyzing the interference of a strongly stirred ring by comparing the deconstruction with the condensate state at release time.

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[2]S. Eckel, et al., *Phys. Rev. X* **4**, 031052 (2014)

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