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Dynamical excitations in a toroidal Bose-Einstein condensate KEVIN C. WRIGHT, A. RAMANATHAN, R.B. BLAKESTAD, W.D. PHILLIPS, G.K. CAMPBELL, JQI, NIST, and U of Maryland — Superfluids flow without dissipation if the flow velocity is below a threshold determined by the lowest energy excitation of the system. We have created a smooth, continuous BEC in a multiply-connected (toroidal) geometry, and investigated the dynamical characteristics of the system by inducing long-lived persistent currents, and perturbing these currents with localized repulsive optical barriers. Dynamical instability caused by the barriers can create quasiparticle excitations in the BEC (e.g. phonons, solitons, vortices) depending on the nature of the perturbation and the system geometry. If the perturbation is large enough, these excitations cause discrete phase slips which change the circulation state of the BEC around the ring. We have examined some of these dynamical processes in our toroidal BEC over a range of experimental conditions.

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