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Detecting phonons and persistent currents in toroidal Bose-Einstein condensates FRANCO DALFOVO, INFM-BEC and Dipartimento di Fisica, Universita' di Trento, Italy, MICHELE MODUGNO, LENS and Dipartimento di Matematica Applicata, Universita' di Firenze, Italy, CESARE TOZZO, Scuola Normale Superiore, Pisa, Italy — We theoretically investigate the dynamic properties of a Bose-Einstein condensate in a toroidal trap. We show that a time periodic modulation of the transverse confinement gives rise to a space periodic density pattern along the torus as a consequence of parametric amplification of pairs of Bogoliubov phonons propagating in opposite directions. This process is analogous to Faraday's instability of classical fluids in annular resonators. If the trap is switched off, the periodicity of both density and momentum distributions produces a peculiar flower-like density distribution of the freely expanding gas. By imaging the expanded condensate one obtains i) a precise determination of the Bogoliubov spectrum and ii) a sensitive detection of quantized circulation in the torus. The parametric amplification is also sensitive to thermal and quantum fluctuations.

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