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**Collective modes of trapped Bose-Einstein condensates undergoing adiabatic deformation from filled-sphere to thin-shell geometries**[1]

COURTNEY LANNERT, Smith College, KUEI SUN, The University of Texas at Dallas, KARMELA PADAVI'C, SMITHA VISHVESHWARA, University of Illinois at Urbana-Champaign — Collective modes of a trapped Bose-Einstein condensate (BEC) are closely related to the ground-state density profile and are experimentally measurable. They are particularly useful for characterizing a BECs three-dimensional structure that cannot be well resolved by the two-dimensional absorption imaging. In this context, it is essential to understand the signatures of collective modes of a BEC in various typical geometries and how they change with the geometry. Here, we study a BEC confined in a spherical trap that is tunable to shape the BEC to be a filled sphere, a thin shell, or any crossover stage between them. We employ hydrodynamic treatments and real-time simulations of the Gross-Pitaevskii equation to obtain the collective modes. We find a set of radial modes that can distinguish a sphere from a shell, and an oscillation frequency dip in a crossover region where the central density becomes low. We also explore the angular modes and find a crucial role of the shell BECs inner boundary, which the sphere BEC lacks. Our findings ought to help future experimental investigations on recently realized BECs in bubble-trap potentials.

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