Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **430** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Quantum bifurcations in a Bose-Einstein condensate

Monday, 7 June 2021 12:08 (4 minutes)

We model an atomic Bose-Einstein condensate (BEC) near an instability, looking for universal features. Instabilities are often associated with bifurcations where the classical field theory provided here by the Gross-Pitaevskii equation predicts that two or more solutions appear or disappear. Simple examples of such a situation can be realized in a BEC in a double well potential or in a BEC rotating in a ring trap. We analyze this problem using both Bogoliubov theory and exact diagonalization. The former describes elementary excitations which display complex frequencies near the bifurcation. We make connections to the description of bifurcations using catastrophe theory but modified to include field quantization.

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Session Classification: M1-1 Degenerate Quantum Gases and cold Atoms and Molecules (DAMOPC) / Gaz quantiques dégénérés et atomes et molécules froids (DPAMPC)

Track Classification: Atomic, Molecular and Optical Physics, Canada / Physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)