Visualization of Dimensional Effects in Collective Excitations of Optically Trapped Quasi-Two-Dimensional Bose Gases

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We study collective frequencies due to the dimensional effects in elongated quasi-two-dimensional (2D) optically trapped Bose gases. With the hydrodynamic theory of superfluids, the key ingredient accounting for the dimensional effects is the equations of state μ_{Q2D} for quasi-2D Bose gases, which is obtained via the path integral method. The resulting frequency shift, proportional to the ratio a_{3D}/a_{2D} between the 3D and effective 2D scattering coupling constant, is compared with other corrections due to the finite size, nonlinearity, thermal effect and the presence of quantum vortex. We show that for reasonable choices of the relevant parameters of the system, such dimensionality correction is the leading contribution, well in reach for the ongoing experimental techniques. [1]

[1]Ying Hu and Zhaoxin Liang, Visualization of Dimensional Effects in Collective Excitations of Optically Trapped Quasi-Two-Dimensional Bose Gases, arXiv:1103.3079.