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Breathing is different in the quantum world[1] MICHAEL BONITZ, SEBASTIAN BAUCH, KARSTEN BALZER, CHRISTIAN HENNING, DAVID HOCHSTUHL, Kiel University, Inst. Theoretical Physics and Astrophysics — Interacting classicle particles in a harmonic trap are known to possess a radial collective oscillation – the breathing mode (BM). In case of Coulomb interaction its frequency is universal – it is independent of the particle number and system dimensionality [1]. Here we study strongly correlated quantum systems. We report a qualitatively different breathing behavior: a quantum system has *two BMs* one of which is universal whereas the frequency of the other varies with system dimensionality, the particle spin and the strength of the pair interaction. The results are based on exact solutions of the time-dependent Schrödinger equation for two particles and on time-dependent many-body results for larger particle numbers. Finally, we discuss experimental ways to excite and measure the breathing frequencies which should give direct access to key properties of trapped particles, including their many-body effects [2].

[1] C. Henning et al., Phys. Rev. Lett. 101, 045002 (2008)
[2] S. Bauch, K. Balzer, C. Henning, and M. Bonitz, submitted to Phys. Rev. Lett., arXiv:0903.1993

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