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Efimov trimers under confinement: From discrete to continuous scaling symmetry JESPER LEVINSEN, Aarhus University, PIETRO MASSIGNAN, Institute of Photonic Sciences, Barcelona, MEERA PARISH, University College London — The effect of dimensionality and confinement on the interactions between particles is key to understanding the behaviour of many quantum systems. Classic examples range from the fractional quantum Hall effect and high temperature superconductivity to the adsorption of molecules on a surface. As a general rule, one expects confinement to favour the binding of particles. However, attractively interacting bosons apparently defy this expectation: while three identical bosons in three dimensions can support an infinite tower of Efimov trimers, only two universal trimers exist in the two dimensional (2D) case. Here we reveal how these two limits are connected by investigating the problem of three bosons confined by a harmonic potential along one direction. We show that the confinement breaks the discrete Efimov scaling symmetry and destroys the weakest bound trimers. However, the deepest bound Efimov trimer persists under strong confinement and hybridizes with the quasi-two-dimensional trimers, yielding a superposition of trimer configurations that effectively involves tunnelling through a short-range repulsive barrier. Our results have immediate impact on the ongoing efforts to observe Efimov scaling in an ultracold atomic gas.

Jesper Levinsen
Aarhus University

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