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Spherical shells buckling to the sound of music ANNA LEE, JOEL MARTHELOT, PEDRO REIS, Massachusetts Inst of Tech-MIT — We study how the critical buckling load of spherical elastic shells can be modified by a fluctuating external pressure field. In our experiments, we employ thin elastomeric shells of nearly uniform thickness fabricated by the coating of a hemispherical mold with a polymer solution, which upon curing yields elastic structures. A shell is submerged in a water bath and loaded quasi-statically until buckling occurs by reducing its inner volume with a syringe pump. Simultaneously, a plunger connected to an electromagnetic shaker is placed above the shell and driven sinusoidally to create a fluctuating external pressure field that can excite dynamic vibration modes of the shell. These dynamic modes induce effective compressive stresses, in addition to those from the inner pressure loading, which can modify the critical conditions for the onset of buckling. We systematically quantify how the frequency and amplitude of the external driving affects the buckling strength of our shells. In specific regions of the parameter space, we find that pressure fluctuations can result in large reductions of the critical buckling pressure. This is analogous to the classic knock-down effect in shells due to intrinsic geometric imperfections, albeit now in a way that can be controlled externally.

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