Let's deflate that beach ball

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FIG. 1. Two deflated balls with different thickness/radius ratios.

We investigate the relationship between pre-buckling and post-buckling states as a function of shell properties, within the deflation process of shells of an isotropic material. With an original and low-cost set-up that allows to measure simultaneously volume and pressure, elastic shells whose relative thicknesses span on a broad range are deflated until they buckle. We characterize the post-buckling state in the pressure-volume diagram, but also the relaxation toward this state. The main result is that before as well as after the buckling, the shells behave in a way compatible with predictions generated through thin shell assumption, and that this consistency persists for shells where the thickness reaches up to 0.3 the shell's midsurface radius.

Bibliography : G. Coupier, A. Djellouli, C. Quilliet Eur. Phys. J. E, 42, paper No. 129 (2019).