Drops levitating on non-pulsed air cushion can form star shapes

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We report on the spontaneous oscillations of drops levitating above an air cushion at room temperature, eventually inducing the appearance of 'liquid stars' after the break-up of axisymmetry. Since the air flow is provided at constant rate, the shape oscillations occur after an instability which origin remained unexplained. Given this oscillatory instability, the star-shapes then arise from a parametric forcing due to the temporal modulation of eigen frequencies. We model the levitated droplet using the axisymmetric Boundary Integral method for the droplet, including viscous damping, and the lubrication approximation for the air flow below the droplet. This results either in stable shapes, oscillatory instabilities and 'chimney' instabilities - gas pockets breaking through the drop, which are the three observed scenarios in experiments. To back-up numerical results, we show experiments that allow the observation and quantitative measurements of star drops of various spatial modes. We finally propose some clues for the resolution of the driving mechanism for oscillations.