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Giant bubble-pinchoff[1]

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Self-similarity has been the paradigmatic picture for the pinch-off of a drop. Here we will show through high-speed imaging and boundary integral simulations that the inverse problem, the pinch-off of an air bubble in water, does not obey self-similarity (of the first kind): A disk is quickly pulled through a water surface, leading to a giant, cylindrical void, which at collapse creates an upward and a downward jet. The neck radius h(tau) of the void does NOT scale with the inertial power law exponent 1/2 (i.e., does not obey "Rayleigh-scaling"). This is due to a second length-scale, the inverse curvature of the void,which follows a power-law scaling with a different exponent. Only for infinite Froude numbers the scaling exponent 1/2 is recovered. In all cases we find the void-profile to be symmetric around the minimal void radius up to the time the airflow in the neck deforms the interface.

[1]In collaboration with Raymond Bergmann, Devaraj van der Meer, Mark Stijnman, and Andrea Prosperetti, University of Twente.