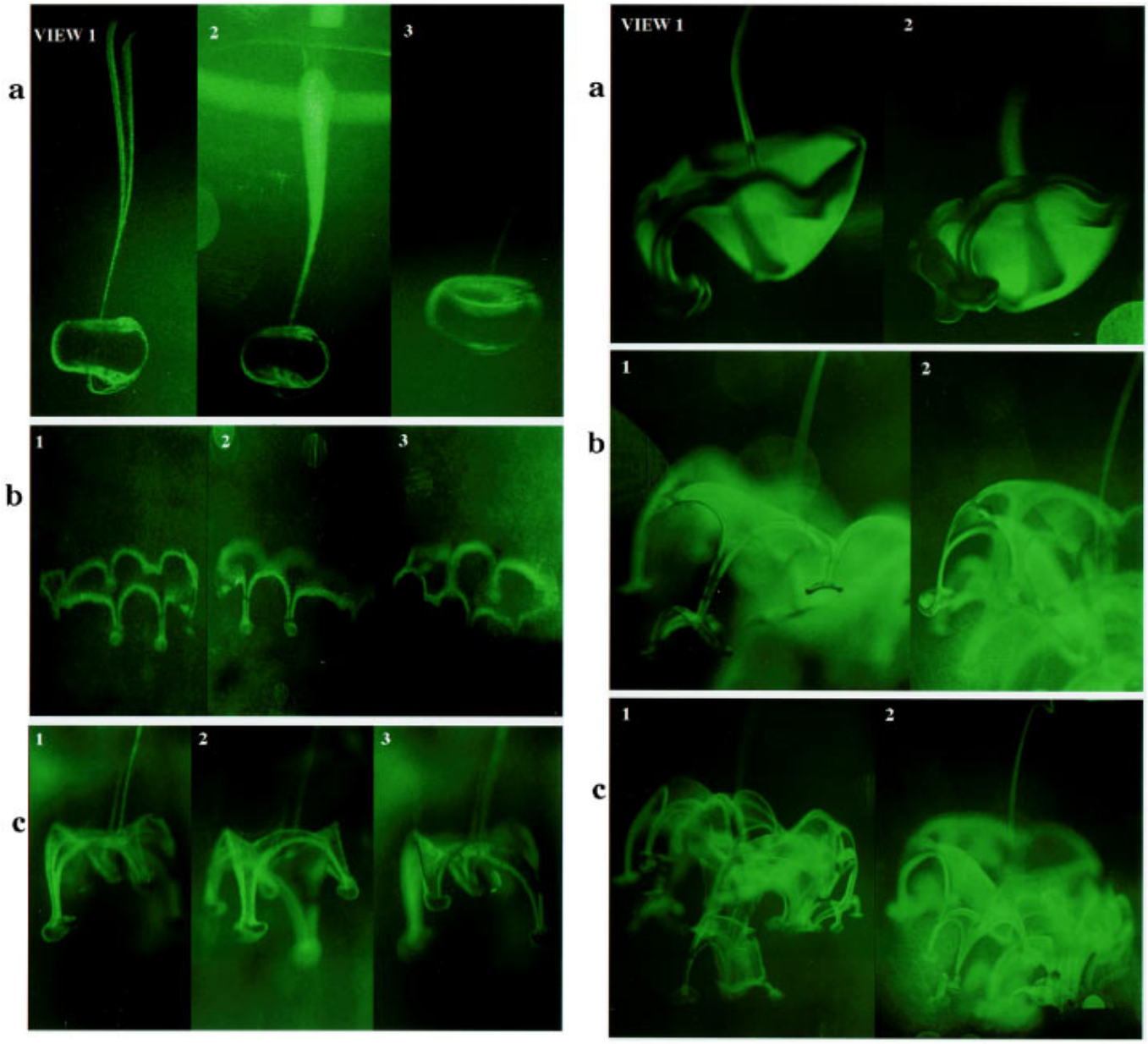

Vortex-ring instability

Bag-shaped instability

3-D VISUALIZATION OF VORTEX-RING AND BAG-SHAPED INSTABILITIES USING HOLOGRAPHY

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Holography is an ideal tool for visualizing three-dimensional (3-D) transient flow structures. Visualization is accomplished by seeding the flow with particles at a high concentration and instantaneously recording their scattered light on a hologram using a pulsed laser beam. The image of the flow marked by the particles is then reconstructed in 3-D space from the hologram, viewed from different angles, and focused at different distances and magnifications. Each set of photographs (a, b, c) displays several views of a holographic image of a drop falling into water. The holographic technique is in-line recording and off-axis viewing (IROV).[4]

Two types of nonlinear breakdown of drops into water are displayed. The drops, aqueous suspensions with 90% water and 0.5 cm in diameter, fell freely from a distance of 1 cm above the water surface. The polystyrene-suspension drop undergoes vortex-ring instability, and the milk drop exhibits bag-shaped instability. Both drops cascade on smaller and smaller scales (droplets, wakelets, ringlets) that yield flow crowns, 3-D arcades, and chaotic structures.[5]

The images demonstrate the power of 3-D visualization by holography. If the particle concentration is reduced to the point where individual particles can be recognized in the holographic images, the technique can be used to measure 3-D velocity fields as in holographic particle image velocimetry.

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