Drop Atomization by laser-induced cavitation

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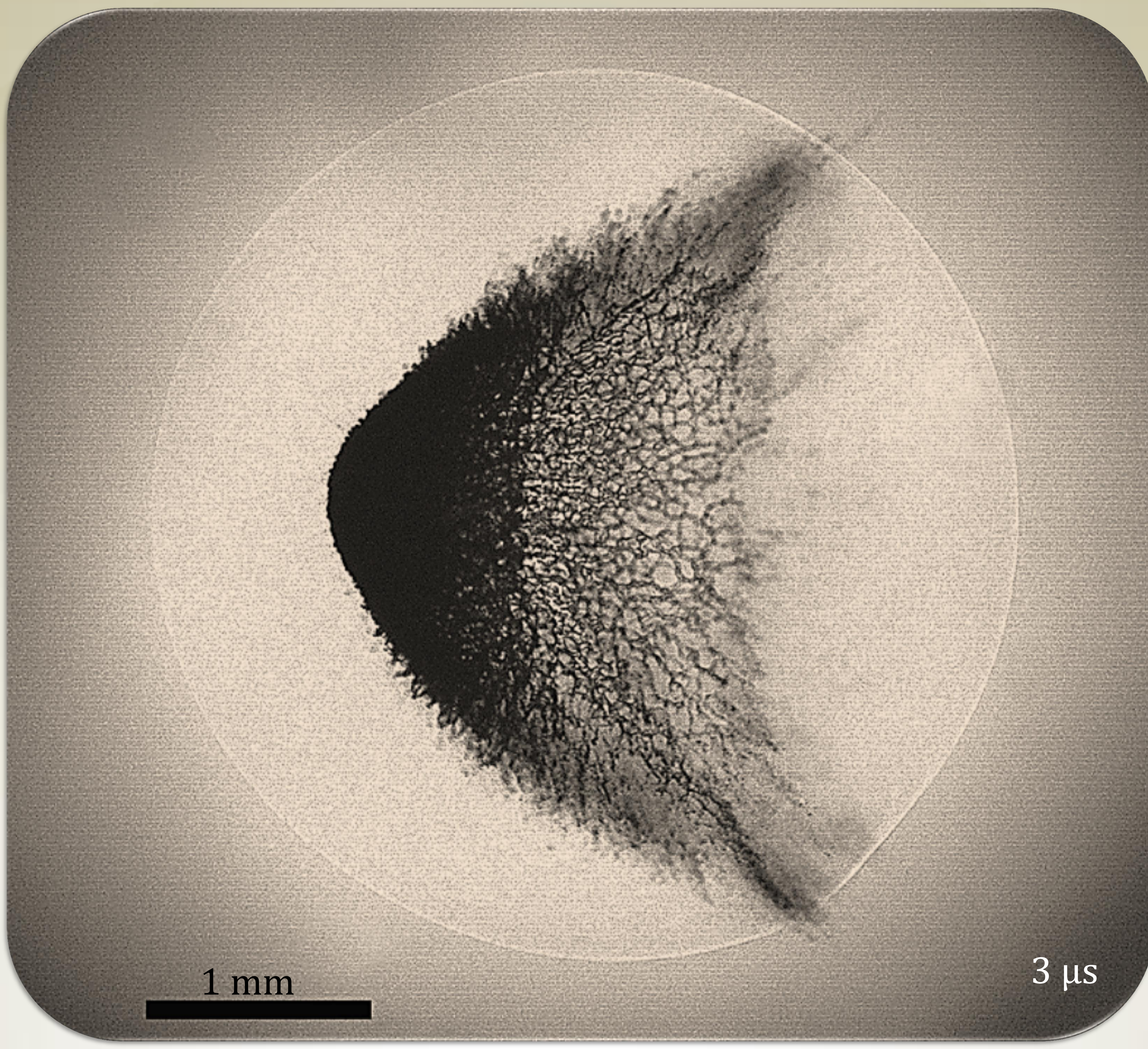

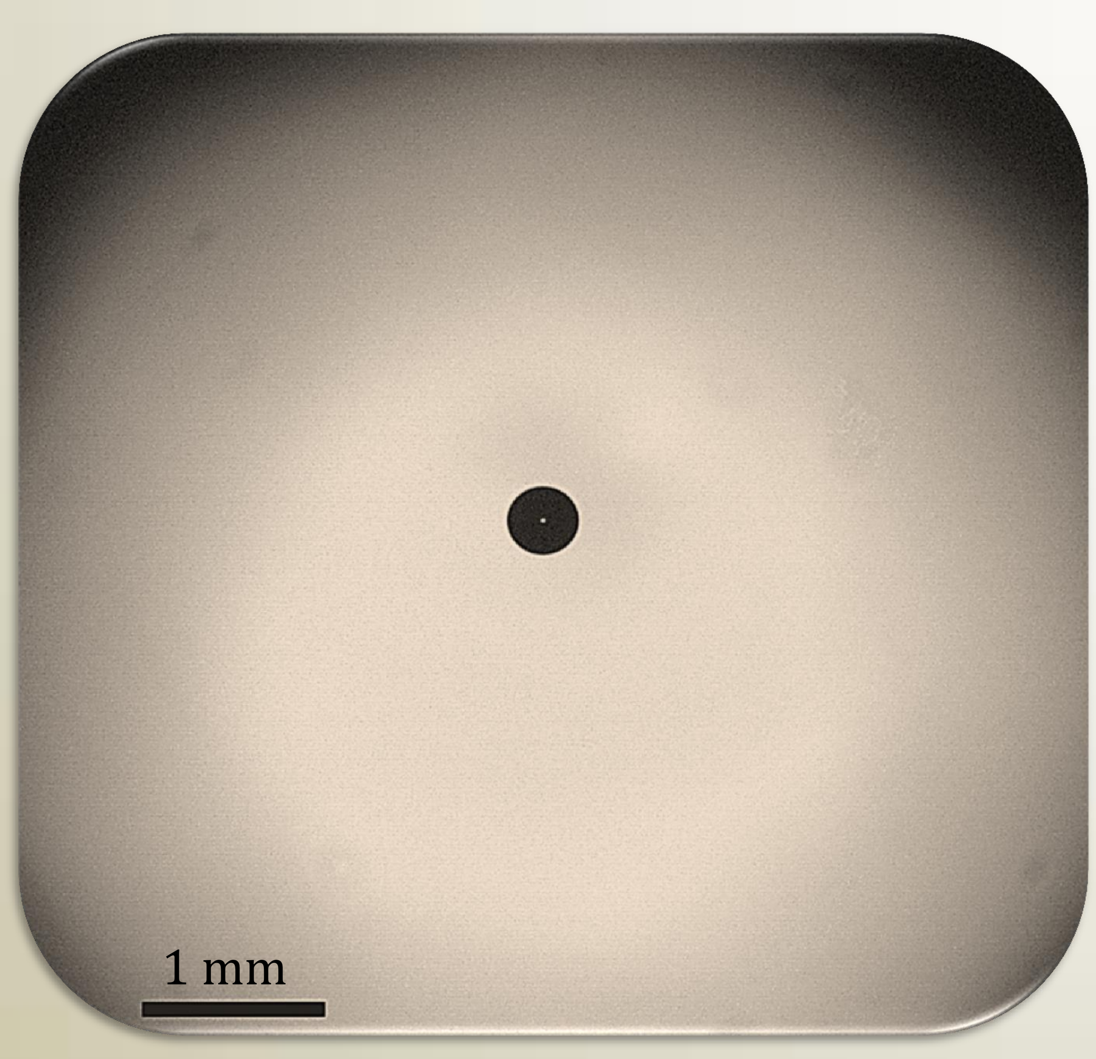

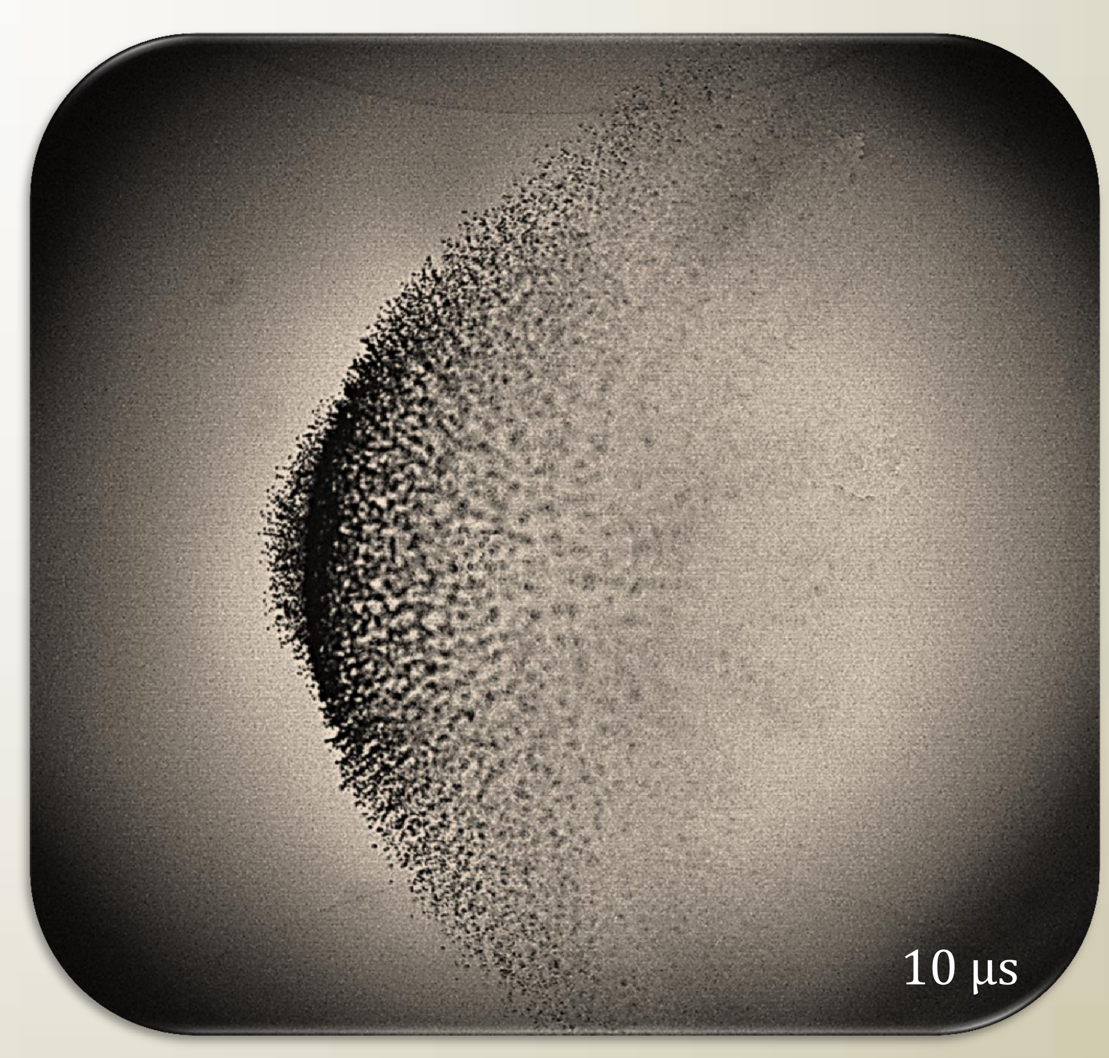

The images show atomization of a liquid drop of water (with a diameter of 0.4 mm) by a focused laser pulse. The laser pulse nucleates a cavitation bubble inside the drop. Already one microsecond after the laser pulse the right side of the drop is ruptured by the expanding cavitation bubble and a shock wave is emitted from the ruptured side. Interestingly, fragments of the droplet are moving ahead of it at speeds of 1200 m/s. After 3 microseconds the drop is expanding with its wall seeded with secondary cavitation bubbles created during the initial nucleation event.

Technical details

The droplet is levitated acoustically using an ultrasonic horn and hit by a focused laser pulse (Nd:YAG 5mJ, 532nm). The scene is illuminated with a 6ns duration red fluorescent pulse induced by a second green Nd:YAG laser. A CCD camera (12 bit Sensicam QE, PCO) captures the strobed pictures. Timing of the lasers and the camera is synchronized with a delay generator (BNC, Berkeley Scientific). A 60 mm macro lens (Nikor) at full magnification gives a resolution of 6.5 mm per pixel. Each drop is imaged twice, the first image is captured just before the fragmentation takes place such that the droplet size can be obtained. The time stamp in each images is the time delay after the laser was fired.