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Cavitation and bubble cloud dynamics in a high-intensity focused ultrasonic field YUAN LU, JOSEPH KATZ, ANDREA PROSPERETTI , Department of Mechanical Engineering, Johns Hopkins University — We focus a high power (200 W max, 500 kHz) ultrasonic beam to generate cavitation in quiescent water, and observe the process using high-speed holography. The intense pressure fluctuations cause corresponding variations in water density and refractive index, generating diffraction patterns that are evident in the holograms. These enable us to map the instantaneous spatial structures of the pressure field, and resolve its mean features, such as pressure nodes in a partial standing wave. At low powers, we observe slow growth of bubbles and their migration to the nodes due to the primary Bjerknes force. At high powers, this process persists in the periphery of the focal zone, but bubble clouds grow explosively near the center of the beam. These clouds travel in the sound propagation direction at a velocity of up to 5 m/s, but slow down briefly at the pressure nodes, while growing and shrinking. The bubbles contain mostly vapor, as the clouds vanishes in $<100\ \mu$ s when the sound is turned off. Likely causes for these phenomena include acoustic streaming, Bjerknes forces, and attenuation of sound in the clouds.

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