

Exercise – Serie 4– Cavitation bubble dynamics: Image Processing

We provide a high-speed movie (BubbleMovie.avi) of the motion of a laser-induced bubble, using background light. The bubble is generated in the center of a cubic water container under atmospheric pressure (see figure below).

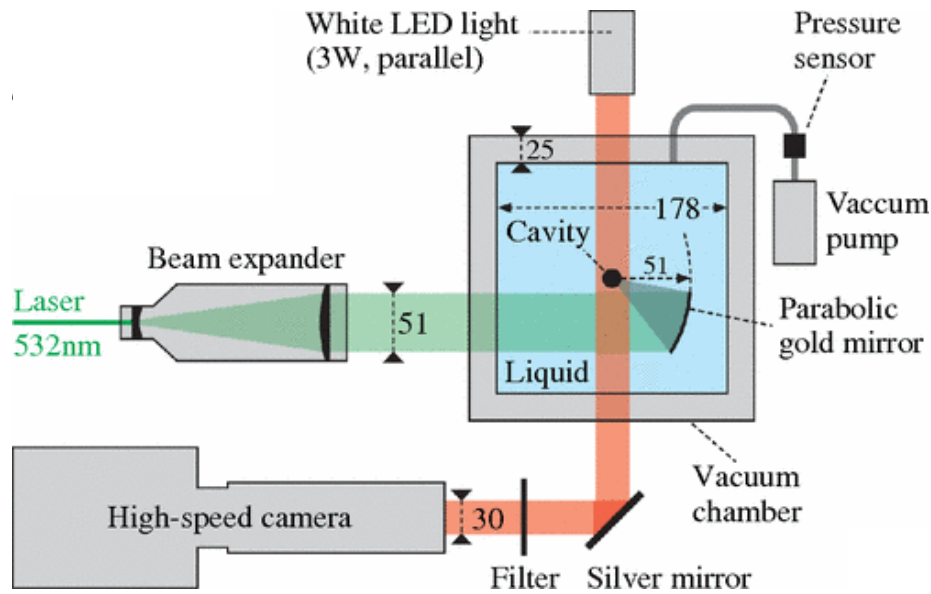


Figure 1 Experimental setup

1. Write a computer program to extract the frames from the movie and analyze them to retrieve the evolution of the non-dimensional radius as a function of non-dimensional time.
2. Compare the experimental data related to the collapse phase with Rayleigh model.
3. By tracking the faint shockwaves in the movie, determine the frame rate of the camera. Evaluate the dimensional values of the collapse time and maximum radius of the bubble. (Hypothesis: The speed of sound in water is 1500 m/s).
4. Compare the experimental data related to the collapse phase with Rayleigh-Plesset model. The partial pressure of the non-condensable gas is 100 Pa.
5. Compare the experimental data related to the collapse phase with Keller-Miksis model. Use the rebound bubble to determine the partial pressure of the non-condensable gas, which leads to the best fit of the data.
6. Produce a video to illustrate the evolution of the pressure field around the bubble during the collapse phase.