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Shockwave-Gas bubble Interaction in Complex Configurations
FENFANG LI, MANISH ARORA, CLAUS-DIETER OHL, Division of Physics and
Applied Physics, School of Physical and Mathematical Sciences, Nanyang Techno-
logical University — Shockwave-gas bubble interaction is relevant in biomedical
applications such as shock wave lithotripsy and histotripsy where cell rupture needs
to be avoided or is advantageous, as well as in the mining industry for microbubble
aerated explosive gels. Here we demonstrate an experimental technique to study
this interaction in a well-controlled manner utilizing microfluidics and high-speed
photography of up to 2 million frames per second. Micron-size gas bubbles are
generated with a continuous wave laser beam modulated with a digital hologram,
whereas the shockwave and an expanding cavitation bubble are created with a pulsed
laser. Gas bubbles are known to generate fast jets when impacted by shockwaves
and we observe jets of 125 m/s and more. Complex interactions are reported for
geometric arrangements of up to 6 gas bubbles: cascaded and simultaneous collapse
of gas bubbles, back reaction of the gas bubbles on the cavitation bubble, and the
deflection of jets for neighbouring bubbles. Besides, we find secondary cavitation
within the liquid film below the expanding cavitation bubble, which is likely due
to trapped gas exposed to low pressures and high shear, i.e. a regime relevant for
cavitation in lubricating films.

Fenfang Li
Division of Physics and Applied Physics,
School of Physical and Mathematical Sciences,
Nanyang Technological University

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