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The visualization of the acoustic feedback loop in impinging underexpanded supersonic jet flows using ultra-high frame rate Schlieren[1]
DANIEL MITCHELL, DAMON HONNERY, JULIO SORIA, Monash University, VIC 3800 Australia — An acoustic feedback model for supersonic jet impingement has been proposed in past literature. Due to the inherent difficulty in measuring highly transient phenomena, models of the feedback process have mostly relied on inference, and comparison to similar subsonic flows. Through the use of ultra-high speed cameras operating at one million frames per second, it has been possible to directly visualize the acoustic feedback loop for the first time. Time resolved Schlieren and shadowgraph image sequences capture the interaction of upstream travelling acoustic waves with the shear layer at the nozzle lip and shock structures within the jet core. The acoustic forcing at the nozzle lip produces a sinusoid like perturbation in the shear layer that is highly transient both temporally and spatially. This perturbation grows rapidly into a Kelvin-Helmholtz like vortex ring. These time resolved measurements offer new insights into the fundamental physical mechanisms governing the acoustic feedback loop in supersonic jet impingement.

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Daniel Mitchell
Monash University, VIC 3800 Australia

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