Jet noise mechanisms

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The sound radiation from subsonic jets is less well understood than that from supersonic jets where there is a direct connection between jet vortical structures and the Mach waves they produce. In subsonic jets the sound originates with wavepackets in the shear layers, but the question of what drives the wavepackets remains unclear.

In this work we demonstrate that a wavepacket driven by a nonlinear interaction between two unstable modes in the jet provides a very efficient mechanism of sound radiation.

Theoretical predictions of the sound are made using the parabolised stability equations (PSE) and additional direct numerical simulations are used to solve the governing equations. The efficiency of the nonlinear mechanism is clear from the simulations and theory. The insight obtained enables the contributions of particular mode interactions to both the directivity and the spectrum of noise radiation to be assessed. Axisymmetric mode interactions are shown to be particularly important, which has implications for jet noise control.

References:

