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Sound amplification by jittering wavepackets in subsonic turbulent jets[1] MENGQI ZHANG, Institut PPRIME - CNRS - Université de Poitiers, AARON TOWNE, California Institute of Technology, PETER JORDAN, Institut PPRIME - CNRS - Université de Poitiers, TIM COLONIUS, California Institute of Technology, GUILLAUME BRÈS, Cascade Technologies, SANJIVA LELE, Stanford University — Recent research confirms that coherent structures in turbulent jets can be understood as hydrodynamic instabilities (wavepackets) of the turbulent mean that amplify and decay as they convect downstream. Linear models used to compute such wavepackets obtain compelling agreement with experiment in terms of both wavepacket structure and phase speed. But the radiated sound can have errors of several orders of magnitude. Data analysis suggests that this is because individual wavepackets evolve, not on the long-time mean of the turbulence, but on a slowly varying mean, which may be described statistically via an ensemble of short-time averages. We use data from a Large Eddy Simulation to explore this idea. The simulation has been carefully validated by an accompanying experiment and found, in particular, to reproduce loud intermittent events observed in the measurements. Slowly varying and short-time-averaged mean flows are extracted from the LES. The Linearised Euler Equations are solved using the slowly varying mean–obtained by low-pass filtering the LES data–as a base flow. The Parabolised Stability and One-Way Euler equations are solved using the short-time ensemble. The solutions comprise jittering wavepackets whose sound radiation is enhanced by several orders of magnitude.

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