Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Instability wavepackets in optimally forced subsonic jets
ONOFRIO SEMERARO, LUTZ LESSHAFFT, LADHYX - Ecole Polytechnique - F-91128, Palaiseau - France — Jets are known to be very receptive to ambient perturbations, due to their strong convective instability. Coherent wavepackets are formed as a result, which may, as recent experiments suggest, represent the dominant source of jet noise. We model these wavepackets as the linear flow response to a harmonic forcing input that yields the highest amplification in a fully non-parallel setting. Axisymmetric turbulent jets are considered. Mean flows are taken from numerical simulations as well as from experiments, characterized by high subsonic Mach numbers ($Ma = 0.84$ and $Ma = 0.9$) and high Reynolds numbers. The formalism relies on singular mode decomposition of the linear resolvent operator, based on the fully compressible Navier-Stokes equations. Two different objectives are used for the optimization: the maximum energy of the near-field wavepacket and the maximum radiated acoustic power. The effects of turbulence are modeled through a turbulent viscosity formulation. The predicted acoustic radiation will be compared against simulation and experiment, and the influence of the chosen turbulent viscosity model will be discussed.

Patrick Huerre
LADHYX - Ecole Polytechnique - F-91128, Palaiseau - France

Date submitted: 22 Jul 2014 Electronic form version 1.4