Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Global modes in hot jets and their acoustic far field LUTZ LESSHAFFT, PATRICK HUERRE, LadHyX, Ecole Polytechnique, France, PIERRE SAGAUT, LMM, University Pierre et Marie Curie, France, MARC TERRACOL, DSNA, ONERA, France — The self-excited, highly synchronized formation of ring vortices in absolutely unstable hot jets is studied in direct numerical simulations. Oscillations in the hydrodynamic near field and in the acoustic far field are computed from the Navier-Stokes equations, resolved on the same computational domain. Experimental near field measurements are reproduced to very good accuracy. The numerically observed vortex shedding frequencies are then compared to the linear instability properties of the unperturbed flow state. It is found that over a range of parameters the onset of self-excited oscillations can be attributed to the presence of absolute instability in sufficiently hot jets, in full agreement with predictions drawn from the theory of nonlinear global modes. In cases where the initial jet shear layer is highly receptive to external forcing, feedback from aeroacoustic disturbances generated downstream may influence the frequency selection process. A highly directive acoustic far field is radiated by nonlinear global modes, concentrated in the direction of the jet axis.

Patrick Huerre
LadHyX, Ecole Polytechnique

Date submitted: 05 Jul 2005 Electronic form version 1.4