Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Coherence resonance in low-density jets[1] YUANHANG ZHU, Hong Kong University of Science and Technology, VIKRANT GUPTA, Southern University of Science and Technology, LARRY K.B. LI, Hong Kong University of Science and Technology — Coherence resonance is a phenomenon in which the response of a stable nonlinear system to noise exhibits a peak in coherence at an intermediate noise amplitude. We report the first experimental evidence of coherence resonance in a purely hydrodynamic system, a low-density jet whose variants can be found in many natural and engineering systems. This evidence comprises four parts: (i) the jets response amplitude increases as the Reynolds number approaches the instability boundary under a constant noise amplitude; (ii) as the noise amplitude increases, the amplitude distribution of the jet response first becomes unimodal, then bimodal, and finally unimodal again; (iii) a distinct peak emerges in the coherence factor at an intermediate noise amplitude; and (iv) for a subcritical Hopf bifurcation, the decay rate of the autocorrelation function exhibits a maximum at an intermediate noise amplitude, but for a supercritical Hopf bifurcation, the decay rate decreases monotonically with increasing noise amplitude. It is clear that coherence resonance can provide valuable information about a systems nonlinearity even in the unconditionally stable regime, opening up new possibilities for its use in system identification and flow control.

[1]This work was supported by the Research Grants Council of Hong Kong (Project No. 16235716 and 26202815).

Yuanhang Zhu
Hong Kong University of Science and Technology

Date submitted: 21 Jul 2017 Electronic form version 1.4