Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Transient growth from the continuous spectrum of a high-speed rapidly-swirling jet ARNAB SAMANTA, GOPALSAMY MUTHIAH, Indian Institute of Science — We investigate the possibility for short-time transient growths involving the helical modes of a rapidly-swirling, high-speed jet that has undergone a sub-critical transition via an axisymmetric vortex breakdown. The base flow is extracted from the time-averaged measurements, consisting of the recirculation bubble and its wake. A pseudospectrum analysis complements a local normal-mode based stability analysis in identifying the continuous spectrum, which is further split into a potential and freestream spectrum, where the non-orthogonality between the former type and the existing discrete stable modes is shown to be the main origin of strong transient growths in such flows. As the swirling flow develops post the bubble collapse, this potential mode spectrum widens, increasing the importance of transient growth inside the wake region. The local transient gains calculated at the wake confirms this, where strong growths far outstrips the exponential modal growth at shorter times, especially at the higher helical orders and smaller streamwise wavenumbers. These short-time transients are likely to be a necessary first-step toward the formation of a wavemaker region at the wake of such flows, leading to their eventual spiral breakdown.

Arnab Samanta
Indian Institute of Science

Date submitted: 30 Jul 2017 Electronic form version 1.4