Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Influence of the multipole order of the source on the decay of an inertial wave beam in a rotating fluid NATHANAEL MACHICOANE, PIERRE-PHILIPPE CORTET, Laboratoire FAST, CNRS, Université Paris-Sud, Orsay, France, BRUNO VOISIN, Laboratoire LEGI, CNRS, Université Grenoble Alpes, Grenoble, France, FREDERIC MOISY, Laboratoire FAST, CNRS, Université Paris-Sud, Orsay, France — Inertial wave beams emitted from localized sources are relevant to a broad range of geo and astrophysical flows. These beams are excited at critical lines, where the local slope of solid boundaries equals the propagation angle of the wave, in rotating fluid domains affected by a global harmonic forcing (e.g. precession, libration, tidal motion). We show here theoretically and experimentally that the decay of the amplitude of such wave beams depends on the multipole order of the source. We analyze the far-field viscous decay of a two-dimensional inertial wave beam emitted by a harmonic line source in a rotating fluid. By identifying the relevant conserved quantities along the wave beam, we show how the beam structure and decay exponent are governed by the multipole order of the source. Two wavemakers are considered experimentally, a pulsating and an oscillating cylinder, aiming to produce a monopole and a dipole source, respectively. The relevant conserved quantity which discriminates between these two sources is the instantaneous flow rate along the wave beam, which is non-zero for the monopole and zero for the dipole. For each source, the beam structure and decay exponent, measured using particle image velocimetry, are found in good agreement with the predictions.

Frederic Moisy
Laboratoire FAST, CNRS, Université Paris-Sud, Orsay, France

Date submitted: 20 Jul 2015 Electronic form version 1.4