Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Tangent double Hopf bifurcation in a counter-rotating split cylinder[1] PALOMA GUTIERREZ-CASTILLO, JUNA M. LOPEZ, Arizona State University — A tangent double Hopf bifurcation has been found in the flow in a counter-rotating cylinder split at its mid-plane. The cylinder of radius a and length h is completely filled with fluid of kinematic viscosity ν. Both halves rotate with the same angular speed ω, but in opposite directions. The flow, which is solved numerically via spectral methods, is dominated by the shear layer between both halves of the cylinder. For sufficiently small $Re = \omega a^2/\nu$, the basic state, which is axisymmetry, reflection symmetric and steady, is stable. A range of aspect ratios $\Gamma = h/a$ were studied, with $\Gamma \in [0.5, 2]$. The basic state loses stability via a number of different Hopf bifurcations breaking axisymmetry, leading to waves with different azimuthal wavenumbers. For $\Gamma \in [1.3, 1.76]$, there is a double Hopf bifurcation of waves with $m = 2$ and $m = 3$. This bifurcation divides (Γ, Re) space into 6 different regions, some of which include multiple stable states due to the nonlinearities of the problem. The states in the various regions are very well described by the normal form dynamics of the bifurcation, which we use to gain deeper insights into the complicated dynamics created by the nonlinear competition between the various states.

[1]U.S. National Science Foundation grant CBET- 1336410

Paloma Gutierrez-Castillo
Arizona State University

Date submitted: 25 Jul 2016 Electronic form version 1.4