

Abstract Submitted  
for the DFD20 Meeting of  
The American Physical Society

**Numerical simulation of a triple flame in a swirling flow**<sup>1</sup> XIAO ZHANG, JOSEPH CHUNG, CAROLYN KAPLAN, University of Maryland, College Park, ELAINE ORAN, Texas AM University — A triple (tribranchial) flame consists of a rich premixed flame, a lean premixed flame, and, in between, a diffusion flame, all of which merge at a single point. Recent three-dimensional, unsteady simulations have shown that the blue whirl has a triple-flame structure, in which the merging point of the triple flame forms as a ring surrounding the bubble mode of vortex breakdown within a swirling flow. Now, in order to study how triple flames interact with swirling flows, we examine a configuration in which a swirling flow first evolves into the bubble mode of vortex breakdown with premixed fuel and air injected into the vortex core. After a quasi-steady state is established, the fuel-air mixture is ignited in the upstream portion of the bubble region and a triple flame forms within the vortex core. The flame is lifted above the inlet plane and remains in a stable position throughout the computation. We present and discuss the flame and flow structure and compare it with the blue whirl.

<sup>1</sup>Army Research Office, Army Research Laboratory, National Science Foundation

Xiao Zhang  
University of Maryland, College Park

Date submitted: 10 Aug 2020

Electronic form version 1.4