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**Towards a Numerical Simulation of the Blue Whirl** XIAO ZHANG, JOSEPH CHUNG, RYAN HOUIM, CAROLYN KAPLAN, ELAINE ORAN, Department of Aerospace Engineering, University of Maryland, College Park, MD —
The blue whirl is a newly observed flame structure shown to evolve from a fire whirl. A new computational model is being developed to simulate this phenomenon and help explain the transition and structure. A three-dimensional numerical model was constructed to solve the partially compressible, reactive Navier-Stokes equations. The fourth-order Flux- Corrected Transport (FCT) algorithm is used for convection and the Barely Implicit Correction (BIC) is applied to remove the time step restriction imposed by the sound speed. A simplified chemical-diffusive (CD) model accounts for the chemical-energy release. The diffusion process models the mass diffusion, heat conduction, and viscous diffusion. The CD chemical model implemented here allows for variable equivalence ratios, allowing for computations of both premixed and non-premixed systems without the additional numerical cost of solving a multi-step chemical model and tracking many intermediate species. The implementation of these methods and models along with various test problems are presented.

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