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The Structure of the Blue Whirl[1] SRIRAM BHARATH HARIHARAN, YU HU, HUAHUA XIAO, MICHAEL GOLLNER, ELAINE ORAN, University of Maryland, College Park — Recent experiments have led to the discovery of the blue whirl, a small, stable regime of the fire whirl that burns typically sooty liquid hydrocarbons without producing soot. The physical structure consists of three regions – the blue cone, the vortex rim and the purple haze. The physical nature of the flame was further investigated through digital imaging techniques, which suggest that the transition (from the fire whirl to the blue whirl) and shape of the flame may be influenced by vortex breakdown. The flame was found to develop over a variety of surfaces, which indicates that the formation of the blue whirl is strongly influenced by the flow structure over the incoming boundary layer. The thermal structure was investigated using micro-thermocouples, thin-filament pyrometry and OH* spectroscopy. These revealed a peak temperature around 2000 K, and that most of the combustion occurs in the relatively small, visibly bright vortex rim. The results of these investigations provide a platform to develop a theory on the structure of the blue whirl, a deeper understanding of which may affirm potential for applications in the energy industry.

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