The Dynamic Behavior of Fires: from Wildfires to Fire Whirls

Large wildfires of increasing frequency and severity threaten local populations and natural resources while contributing carbon emissions into the earth-climate system. Although wildfires have been researched and modeled for decades, no verifiable physical theory of spread is available to form the basis for the precise predictions needed to manage fires more effectively and reduce their environmental, economic, ecological, and climate impacts. This presentation will summarize recent research aimed at unraveling how buoyant flame dynamics seen in wildfires contribute to their spread. Experimental research from the laboratory to field scale has contributed to new understanding, describing how unsteady heating from flames propagate forward to unburned fuels, advancing fire spread.

In the most extreme urban and wildland fires, fire whirls can form, presenting significant hazards to firefighters and nearby residents. Until recently, their destructive power has hidden many features of their formation, growth, and propagation. After a brief review of our state of knowledge concerning the fluid dynamics of fire whirls, two new approaches using the intensification of combustion seen in fire whirls to reduce their emissions will be covered. First, exciting recent studies on the blue whirl will be presented, describing how this small, completely blue, soot-free flame that evolves from traditional fire whirls forms. Finally, new results on the use of fire whirls to clean up oil spills over water will be presented, scaling results from laboratory fires up to whirls nearly 1 megawatt in intensity.

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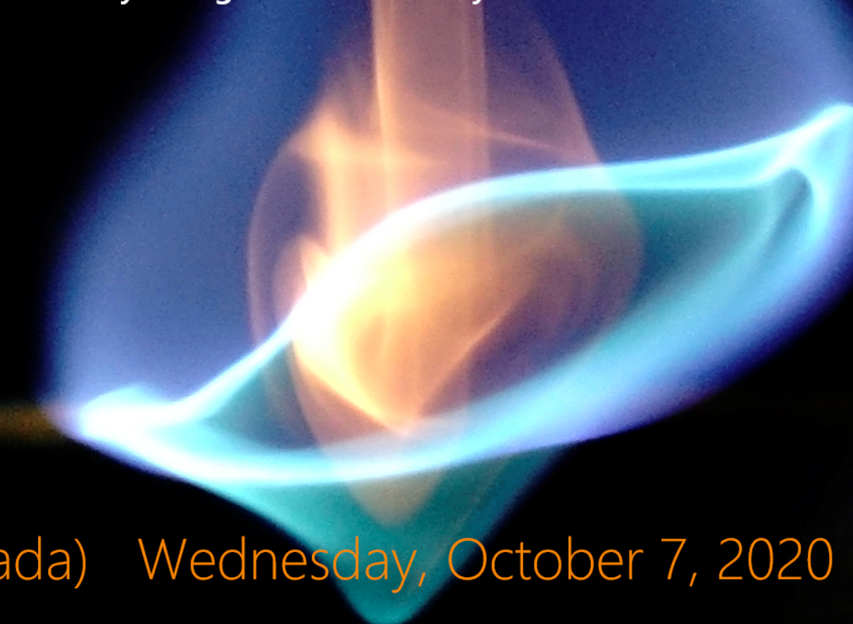

Virtual Colloquium 3:30 to 4:30 p.m. Eastern Time (U.S. and Canada) Wednesday, October 7, 2020