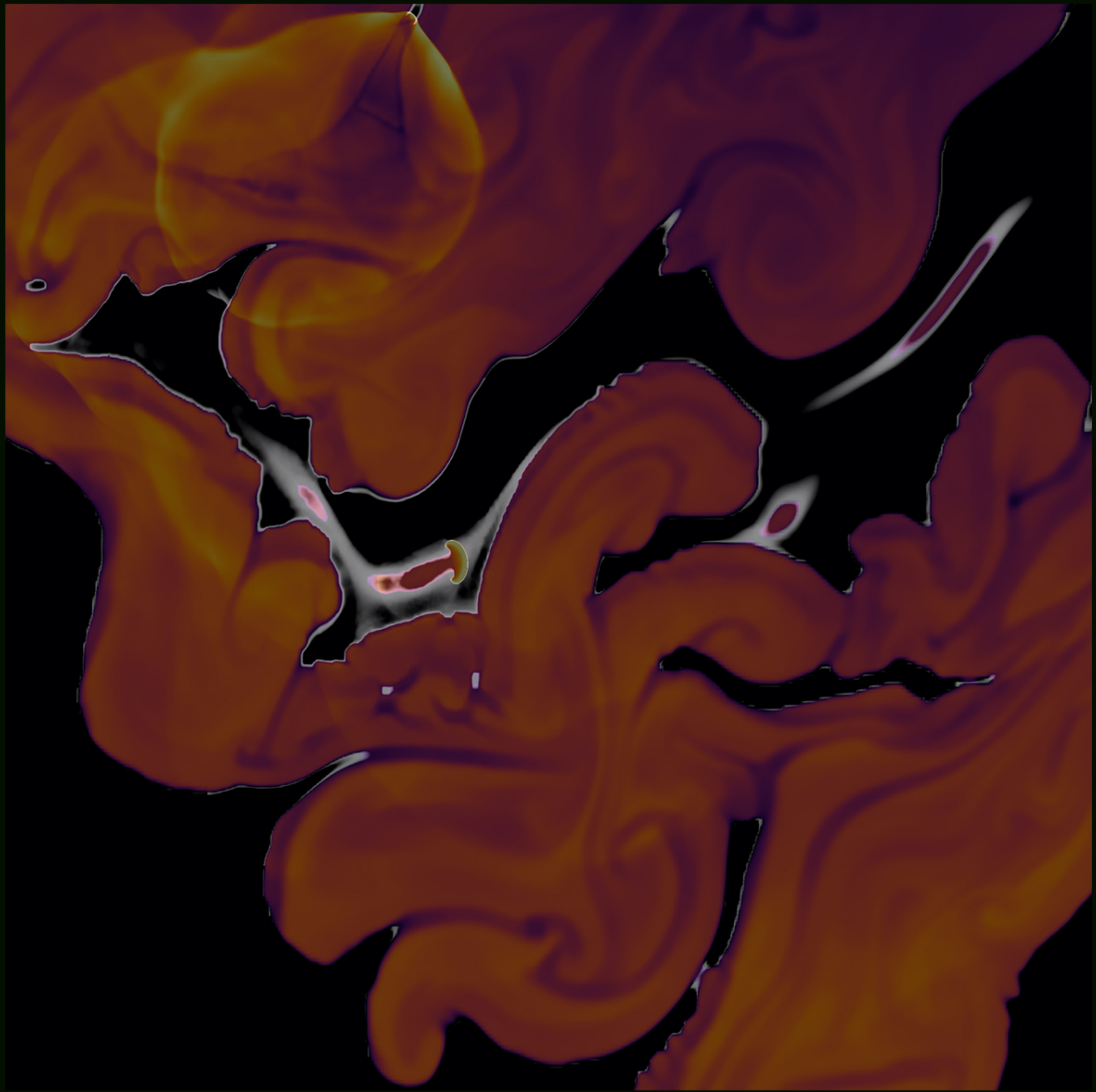

Wildfires, such as those currently burning millions of acres of forest on the West Coast of the US, and uncontrolled industrial explosions, such as the recent event in the port of Beirut, Lebanon are examples of events described by combustion physics. From the physics point of view, these two events represent two different types of reactive waves: forest fires consume fuel relatively slowly in the form of subsonic deflagrations, or flames, while explosions advance supersonically in the form of detonations. Depending on reactivity of the medium, energy released by burning may either slow down or accelerate evolution of those waves. Although the controlling of flames through firefighting is possible in most situations, detonations are far more difficult to manage. In particular, the ability to control the process of the deflagration-to-detonation transition (DDT) offers the last line of defense in situations such as explosions of coal dust/air suspensions in mines.

Deflagrations and detonations are also believed to participate in thermonuclear explosions of white dwarf stars. These events, known to astronomers as Type Ia supernovae (SN Ia), are some of the brightest observed phenomena in the universe. Thanks to their relative intrinsic homogeneity, they play a key role in studying the history and physics of the universe. Although pure deflagration and pure detonation SN Ia models were shown to poorly match observations, an ad hoc introduced transition to detonation led to models offering a much better agreement with data. We present the results of a computational campaign aimed at explaining the nature of DDT occurring in an unconfined environment of exploding luminous Type Ia supernovae.

Detonation Ignition in Turbulent Stellar Plasmas

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Virtual Colloquium 3:30 to 4:30 p.m. Eastern Time (U.S. and Canada) Wednesday, September 23, 2020