Detonation as a Self-Sustained or "Living" Phenomenon

J. E. Shepherd
Graduate Aeronautical Laboratory
California Institute of Technology
Pasadena, CA 91125

The structure of detonation waves was recognized as a central problem in the Gasdynamics of Explosions by Oppenheim. He immediately grasped the significance of the observations of “turbulent” detonation by White and wrote in 1961: “…the detonation may form an essentially non-steady, non-uniform regime so that, in order to explain its precise nature, multidimensional effects in space as well as its irregular behavior in time have to be taken into account.” Since that time, researchers worldwide have being working toward an explanation of this “precise nature”. For example, in Oppenheim’s laboratory during the 1960s and 1970s, there were experimental observations with the laser schlieren method, analyses of wave interactions, and the study of exothermic centers. Despite substantial efforts, the precise nature of detonation fronts still eludes us. I will discuss some recent contributions to our imprecise knowledge, emphasizing the coupling between physical and chemical processes that occurs in highly unstable waves.