Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Multiplicity of detonation regimes in systems with a multi-peaked thermicity MATEI I. RADULESCU, University of Ottawa, FAN ZHANG, Defence Research and Development Canada — Bulk exothermicity in most gaseous detonation waves occurs in a single step. There are however several physical systems displaying multiple thermicity peaks. Examples are the nuclear fusion reactions sequence in supernovae explosions, hybrid detonations in multi-phase fuels and other reactive systems. The multiplicity of steady state detonation regimes in the presence of an endothermic internal or external loss is demonstrated through analysis of the reaction zone structure described by the reactive Euler equations with two sequential Arrhenius reactions. The steady Zel'dovich - Von Neumann- Doering reaction structure is obtained numerically. The reaction zone displays embedded sonic points where the net thermicity vanishes simultaneously. Depending on the magnitude of the losses or endothermic process, the detonation wave speed response was found to have multiple steady states and turning points, which are controlled by the magnitude of the kinetic parameters of each reaction. The dependence on system parameters is established analytically using the Fickett detonation analogue model with two sequential reactions.

Matei I. Radulescu
University of Ottawa

Date submitted: 12 Sep 2012 Electronic form version 1.4