News from the shock front

Hans Goedbloed

FOM-Institute for Plasma Physics 'Rijnhuizen'

& Astronomical Institute, Utrecht University

Shocks are a universal phenomenon of the nonlinear evolution of fluids and plasmas. They occur in the wide variety of laboratory and astrophysical plasmas ranging from the early pinch implosion experiments, and recent inertial confinement fusion experiments, to supersonic accretion flows onto neutron stars and black holes. Also, reconnection processes in magnetized plasmas create shocks that accelerate particles to relativistic speeds, as occur in many astrophysical outflows like extragalactic jets. Similarly, in the laboratory, when a plasma beam is shot onto a solid target, the whole plethora of plasma shocks should appear on the stage.

Shocks occur in fluids at speeds surpassing the sound speed. Similarly, in plasmas shocks occur when one of the critical speeds associated with the many different waves in plasmas is surpassed. I will show that the combination of the early insights of de Hoffmann and Teller (1950) with recent ones on scale independence (Goedbloed and Poedts, 2004) and time-reversal symmetry leads to a new approach in the study of magnetohydrodynamic shocks that is relevant to all mentioned applications.