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Double Shock Waves in Ultrarelativistic Fluid Dynamics

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The only solution of the hydrodynamic equations that propagate in wave form, except for small perturbations, are shock waves. However, shock waves haven't been thoroughly studied in the ultrarelativist limit. In relativistic formulation of hydrodynamics, causality must be intrinsically preserved, which as a consequence limits the maximum group velocity of the theory. This will naturally affect the propagation of ultrarelativistic shock waves, whose velocity can often exceed this maximum group velocity of the theory. In this work, numerical simulations of ultrarelativistic shock waves will be conducted, using MUSIC and Smoothed-Particle-Hydrodynamics, and we will verify the existence of a new phenomenon in this limit, the double shock wave.

Author: OLIVEIRA, Davi (Universidade Federal Fluminense)

Presenter: OLIVEIRA, Davi (Universidade Federal Fluminense)

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