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On the Propagation of Relativistic Shocks in Conductive Media

Relativistic shocks propagating in perfectly conductive plasmas have been extensively studied due to their central role in high energy astrophysical phenomena, with Gamma-Ray Bursts being the most prominent example. In the present work we investigate the mechanism by which a relativistic shock interacts with the propagation medium's electromagnetic field. We assume the propagation of a shock front with a finite length through a magnetized medium, as well as a finite electrical conductivity for the plasma in the shock front's volume. These assumptions necessitate the inclusion of one more jump condition derived through the covariant Gauss-Ampère Law and introduce a dimensionless parameter dependent on the magnetic diffusivity of the plasma in the shock front, the shock front's length, as well as on the shock's propagation four-velocity. We investigate the effects of this parameter's value on shock dynamics and discuss possible applications of this work in the study of Gamma-Ray Bursts.

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