Study of the coupling between the M1 moment model and the Maxwell equations.

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Abstract

The study of the feasibility of inertial confinement fusion requires the development of accurate and fast numerical codes.

First of all, we introduce the PN and M1 models for the study of electrons motion in a plasma. Numerical schemes for these models are described and implemented. A stability study led us to use implicit schemes for collisions operators. Also energy conservation consideration urged us to develop a numerical projection method.

Secondly, the M1-Maxwell coupling has been investigated. The Batishchev test case shows the impossibility to use a classic scheme for the quasi-neutrality limit study. Indeed, the stiffness of the stability constraints of the scheme causes an exorbitant calculation time. We introduce a new stable numerical scheme consistent with the transitional and limit models. Such schemes are called Asymptotic-Preserving (AP) schemes in literature. This new scheme is able to handle the quasi-neutrality limit regime without restrictions on time and space steps.