APFEL: Asymptotic-Preserving Finite volume schemes for Euler-Lorentz models.

The Euler-Lorentz model consists of the Euler equations for a charged particle gas subject to the Lorentz force. It describes the evolution of a plasma submitted to an electro-magnetic field. Our goal is to build a numerical approximation of the solution of such a model when the applied magnetic field is supposed to be strong. Under this hypothesis, the gyroperiod of the considered particles becomes very small, so we have to deal with a small parameter. The aim of this project is to build a finite volume scheme which can simulate such a model for any values of this small parameter, and which is consistent with the limit model when the small parameter tends to zero. Such a scheme is called an Asymptotic-Preserving scheme. Recently, the 2D isothermal mono-fluid case has been studied in a series of works [1, 2] and current work [3] extends this model to the mono-fluid full Euler equations. The aim of the project is to extend this work to the bi-fluid (electrons and ions) case with a coupling through an electric field computed via the quasineutrality constraint.

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Références

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