

Symmetric Plasmas and Their Decay

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Abstract. Spherically symmetric global solutions are shown to exist for the relativistic Vlasov-Maxwell system of plasma physics. In view of a conjectured perturbation result concerning in particular “nearly” symmetric global solutions, we investigate the asymptotic properties of the symmetric solutions. In the case of only one particle species (say ions but no electrons) we get satisfactory decay estimates; in the general case (ions and electrons) we have preliminary results.

0. Introduction

The relativistic Vlasov-Maxwell system (RVMS) consists of Vlasov’s equations for the ion distribution f^+ and the electron distribution f^-

$$\partial_t f^\pm + \hat{u} \partial_x f^\pm \pm (E(t, x) + d\hat{u} \wedge B(t, x)) \partial_u f^\pm = 0, \tag{1}$$

Maxwell’s equations for the electric and magnetic fields

$$d\partial_t E = \text{curl}_x B - d\gamma 4\pi j(t, x), \tag{2}$$

$$d\partial_t B = -\text{curl}_x E, \tag{3}$$

$$\text{div}_x E = \gamma 4\pi \varrho(t, x), \tag{4}$$

$$\text{div}_x B = 0, \tag{5}$$

and the equations for charge and current that couple Vlasov’s and Maxwell’s equations

$$j(t, x) = \int \hat{u} (f^+(t, x, u) - f^-(t, x, u)) du, \tag{6}$$

$$\varrho(t, x) = \int (f^+(t, x, u) - f^-(t, x, u)) du. \tag{7}$$

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