The Role Of Collisionless Shocks In Some Laser-Plasma Problems

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We have recently suggested that low Mach number laminar shocks might provide an explanation for observations of localized electric fields in excess of 10^9 V/m in compressed pellets relevant to inertial fusion and of accelerated ion beams generated in gas jet targets [1]. The theory is based on the well-known ion sound solitary wave and shows that the inclusion of finite ion temperature produces partial reflection of the ions, destroying the symmetry of the solitary wave and leading to a laminar shock-like structure within a range of low Mach numbers.

After reviewing the theory we will expand on these earlier results, exploring in more detail the limits within which these structures exist, and how the acceleration of narrow energy spectrum ion beams scales with the parameters of the system. We will also explore the way in which existence of such structures within D-T fusion targets may produce partial separation of the species. Finally we will note that there is a very extensive literature on solitary waves in space and laboratory plasmas to which the modifications produced by finite ion temperature may also be relevant.

We wish to acknowledge support for this work by the UK science and Engineering Research Council.

[1 R.A. Cairns , et. al., *Physics of Plasmas* **56**, 022112 (2014)