

P2.4005 Supersolitary waves in electron-ion plasma?

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.4005.pdf>

The newly developed concept of supersolitary wave (supersoliton) describes a novel type of nonlinear localized structure. Its signature features are a very large amplitude in the electrostatic potential (pulse) and a characteristic wiggly structure in the associated electric field. Firstly, supersolitons were suggested in the context of four-species plasmas [1]. Further studies showed that they can exist even in three-species plasmas [2]. It has been argued that such a structure cannot occur in two-species (electron-ion) plasmas [3] based on fluid theory.

Our numerical investigation presented here, based on the kinetic approach using a VlasovPoisson simulation algorithm, provides evidence that supersolitary waves may indeed exist in two-species plasmas. Fig. 1 presents two different snapshots from our simulation results, at $t = 0$ and at $t = 70$ periods. Although our results suggest that these solutions remain stable during propagation, the observed structures fail to survive head-on collisions.

Figure 1: Two time snapshots are shown of the electron and ion distribution function(s) (first and second row), the charge density (3rd row), the electric field (4th row) and the electrostatic potential (last row).

References

[1] A. E. Dubinov and D. Y. Kolotkov., IEEE Transactions on Plasma Science 40, 1429-1433 (2012) [2] F. Verheest, M. A. Hellberg, and I. Kourakis, Physics of Plasmas 20, 012302 (2013) [3] F. Verheest, G. S. Lakhina, and M. A. Hellberg, Physics of Plasmas 21, 062303 (2014)

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Presenter: HOSSEINI JENAB, S. (EPS 2019)

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