



Solitary and Shock Waves in Dusty Plasmas, and Some Open Issues

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A plasma with dust is roughly known as a dusty plasma. Dust particles in a plasma are not neutral, but are either negatively or positively depending on the ambient plasma environments. Two commonly used dusty plasma models (viz. plasma with stationary charged dust and plasma with mobile charged dust) are considered. The basic features of solitary (Mamun et al. 1996, Mamun 1999, Mamun and Shukla 2002a) and shock (Mamun and Shukla 2002b, Mamun and Cairns 2009) waves associated with both dust-ion-acoustic (DIA) waves (which arise due to the compression and rarefaction of inertial ions in presence of inertialess electrons and stationary charged dust) and dust-acoustic (DA) waves (which arise due to compression and rarefaction of charged dust in presence inertialess electrons and ions) are identified. It is observed that i) the dusty plasma system with stationary charged dust supports the DIA solitary and shock waves with positive or negative electrostatic potential depending on the amount of stationary charged dust present; ii) the dust charge fluctuation acts as a new source of dissipation, and is responsible for the formation of the DIA shock structures; iii) the dusty plasma system with mobile charged dust supports the DA solitary waves with negative electrostatic potential only; iv) the strong correlation among the highly charged dust is an alternative source of dissipation, and is responsible for the formation of the DA shock structures. The implications of these results in some laboratory experimental observations (Nakamura et al. 1999, Luo et al. 1999, Nakanura and Sharma 2001, Bandyopadhyay et al. 2008, Heinrich et al. 2009) and some open issues in identifying the properties of the DIA and DA solitary waves are pinpointed.

References

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