Response to "Comment on 'Solitary waves and double layers in an ultra-relativistic degenerate dusty electron-positron-ion plasma'" [Phys. Plasmas 19, 064703 (2012)]

Cite as: Phys. Plasmas **19**, 064704 (2012); https://doi.org/10.1063/1.4725497
Submitted: 12 April 2012 • Accepted: 18 April 2012 • Published Online: 19 June 2012

N. Roy

Response to "Comment on 'Solitary waves and double layers in an ultra-relativistic degenerate dusty electron-positron-ion plasma'" [Phys. Plasmas 19, 064703 (2012)]

N. Roy
Department of Physics, Jahangirnagar University, Savar, Dhaka 1342, Bangladesh

(Received 12 April 2012; accepted 18 April 2012; published online 19 June 2012)

The investigation of the occurrence of nonlinear electrostatic waves (viz., solitary waves and double layers) in degenerate plasmas was the main concern of the article presented by Roy *et al.* [Phys. Plasmas **19**, 033705 (2012)]. The equations of state used in the article were the limits explained by Chandrasekhar [Mon. Not. R. Astron. Soc. **170**, 405 (1935)]. It was designated as "misleading" by some authors, which is opposed in this reply with explanation. © *2012 American Institute of Physics*. [http://dx.doi.org/10.1063/1.4725497]

I. REPLY TO THE COMMENT

The degenerate pressure, which arises due to the combined effect of Pouli exclusion principle and Heisenberg's uncertainty principle, depends only on the fermion number density, but not on its temperature.[1] The equation of state (EoS) for degenerate matters was studied by Chandrasekhar,[2] namely non-relativistic and ultra-relativistic limits. In his paper, Chandrasekhar built the concept first on the mass density and in gravitational equilibrium, pressure density, and the equations were built up for electron-proton system. A number of authors have used these limits to make their theoretical investigations.[3–5] The EoS [$P_j \propto n_j^{\gamma}$ (j stands for electron and positron) and for non-relativistic limits $\gamma = \frac{5}{3}$ and $\gamma = \frac{4}{3}$ for ultra-relativistic limits, where P_j is the pressure of degenerate particles and n_j is the number density of the particles] used in the investigation in Ref. 1, and others like Refs. 3–5 are based on the fact that the equilibrium density of the constituents (like electron, positron, ion, etc.) is very high.[1,3,4] In Ref. 3, the range of number density of typical white dwarf stars was calculated where the EoS was that of the ultra-relativistic limit of Chandrasekhar.[2] The number density almost coincided with the density structure of the comment paper. So, the effect of the polytropic index, γ prescribed by the comment paper, which is based on the density parameter, has no significant effect. And also, the point on what the investigation of Ref. 1 is designated as a "misleading," is not appropriate.

In Ref. 1, fermions are initially treated as degenerate, and the "pseudo-potential" was discussed briefly for the ultra-relativistic limit. The density ratios (like α_e, α_p, etc.) were chosen such that the effect of γ discussed in the "comment paper" is negligible.[1] From both the point of views of number density scale and number density ratio, it is clear that the original article, Ref. 1, is an appropriate investigation.

[1]N. Roy, S. Tasnim, and A. A. Mamun, Phys. Plasmas **19**, 033705 (2012).
[2]S. Chandrasekhar, Mon. Not. R. Astron. Soc. **170**, 405 (1935).
[3]A. A. Mamun and P. K. Shukla, Phys. Lett. A **324**, 4238 (2010).
[4]A. A. Mamun and P. K. Shukla, Phys. Plasmas **17**, 104504 (2010).
[5]W. F. El-Taibany and A. A. Mamun, Phys. Rev. E **85**, 026406 (2012).

