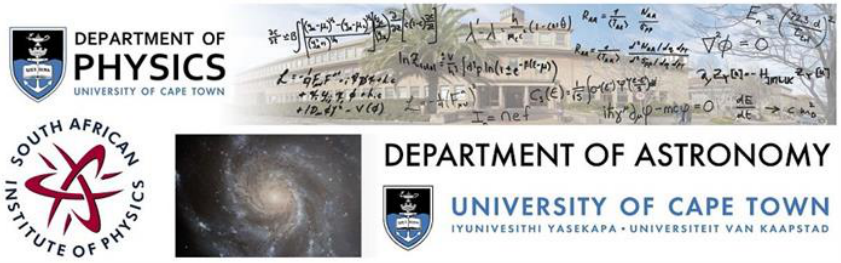

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Nonlinear dust-acoustic waves in the nighttime polar mesosphere

Tuesday, 5 July 2016 10:00 (20 minutes)

Abstract content
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Large amplitude nonlinear potential structures are investigated for a four-component plasma model which is closely aligned with the plasma composition in the nighttime polar mesosphere (~80-90 km altitude)[1]. Nano-sized dust grains (with radii exceeding 2 nm) become positively charged when immersed in a three-component plasma composed of electrons, positive ions and negative ions provided that the negative ions are sufficiently heavy and abundant. This is because the mechanism by which the nano-sized grains become charged is through the capture of currents as secondary electron emission and photo-electron emission processes do not play a role. The existence of large amplitude nonlinear soliton and double layer structures is investigated for broad regions in parameter space. The model will be varied by retaining the inertia of the heavy ion species and these will be treated as dust whereas the electrons and the ionic components which are very much lighter than the dust will be assumed to be isothermal species which are Boltzmann distributed. The study will establish how the polarity of the nano-sized dust grains influences the polarity of the supported solitons.

[1] Observations of positively charged nanoparticles in the nighttime polar mesosphere, M. Rapp, J. Hedin, I. Strelnikova, M. Friederich, J. Gumbel, and F. ̃J. Lübken, Geophys. Res. Letters. 32, L23821, doi:10.1029/2005GL024676 (2005).

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