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Stationary electrostatic structures revisited[1] MARTIN V. GOLDMAN, DAVID L. NEWMAN, DANIEL MAIN, University of Colorado at Boulder, ANDRE MANGENEY, Observatoire de Paris, France — With recent advances in computer simulations and measurements of naturally-occurring nonlinear electrostatic structures in space, it is worth revisiting the relationship between solitons, phase-space holes, and double-layers. Pseudopotential methods are used to explain several interesting new features of 1D nonlinear electrostatic structures. Analytic and numerical solutions explain why the scaling of bipolar field width-to-height ratios are *opposite* for electron phase-space holes and for ion-acoustic solitons. Preliminary results suggest that weak electrostatic field structures in the solar wind may correspond to ion-acoustic solitons. In other studies we show how double layers and solitons can morph into each other. Slight alterations in the pseudopotential for a double layer (potential ramp) can transform the double layer into a soliton (bipolar field) and vice-versa. Double layers, ion solitons and the relationships between them are studied for the case of one ion species drifting with respect to electrons and for the case of two ion species drifting with respect to each other and with respect to electrons. Vlasov simulations relevant to the upward current region of the auroral ionosphere where oxygen and hydrogen are accelerated to different velocities [D. Main, this meeting] demonstrate these properties.

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