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Transverse Acceleration of Ionospheric Ions by Localized Fields¹ A.K. RAM, PSFC–MIT — Rocket observations in the auroral ionosphere show the existence of spatially localized intense electric fields in density depleted regions [1]. The spatial extent of the localized fields is small compared to the thermal Larmor radii of the ambient ions. It is also found that an energized population of ions emanates from these regions. The ions are accelerated transverse to the geomagnetic field and the gain in energy is sufficiently large to allow the ions to escape the ionosphere and populate the magnetosphere. The linear model of wave-particle interactions cannot explain the observed gains in energy. I have been studying, theoretically and computationally, the characteristic features of localized fields in density cavities, and the nonlinear interaction of ions with such fields. Details of these calculations and comparisons with observations will be discussed. The interaction of low energy ions with localized electrostatic field structures is found to be significantly different from the interaction with a set of plane waves [2]. The acceleration occurs over a shorter time scale and the phase space of the energized ions is chaotic. For long-time interactions the ions can undergo large energy gains akin to Lévy flights. [1] K.A. Lynch et al., J. Geophys. Res. 104, 28,515 (1999). [2] A.K. Ram, A. Bers, and D. Benisti, J. Geophys. Res. 103, 9431 (1998).

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