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# Towards a Unified Theory of Auroral Acceleration by Alfvenic Electrostatic Plasma Structures at Earth and Jupiter

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Resent Juno's observations show that Jupiter's aurora is surprisingly different from Earth's aurora. For example, field-aligned currents connecting Jupiter with its magnetosphere seem to be too weak to explain the generation of the powerful Jupiter auroral emissions. The stochastic-like broadband electron acceleration is considered to be responsible for providing the greatest downward electron energy fluxes over the main auroral regions (e.g., Mauk et al., 2018). These exciting results challenge our theoretical understanding of the auroral acceleration. We will present a theory of the generation of electrostatic fields and auroral formation which may be applied to the Jovian auroral environment as well as to the Earth's magnetosphere.

Electrostatic fields are the most efficient and powerful means for discrete auroral particle acceleration. We will first elucidate the generation of parallel electrostatic fields by Alfvenic interaction in the inhomogenous Ionosphere-Magnetosphere-Solar Wind (I-M-SW) coupling system. Both inverted-V and broadband auroral acceleration require the generation of the electrostatic fields, and they should have a unified mechanism. We then introduce the Alfvenic electrostatic plasma structure, which can be created by the nonlinear interaction of Alfven wave packets in the inhomogeneous auroral I-M-SW coupling system. The structure includes a localized long-lasting electrostatic field embedded in low density cavities and surrounded by enhanced reactive stresses. The dynamical structure acts as an effective high energy particle accelerator and the source of EM radiation. The application of these theories to the interpretation of the observed auroral processes at Jupiter and at Earth will be discussed.