BOUNCE-AVERAGED GUIDING-CENTER SIMULATIONS OF PLASMASHEET ELECTRONS FOR COMPARISON WITH PIXIE AND UVI DATA

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ADIABATIC INVARIANTS

$M = p_{\perp}^{2}/2m_0B$ $\qquad$ $J = \oint p_{\parallel}\,\mathrm{d}s$ $\qquad$ $\Phi = \oint \mathbf{B} \cdot \mathrm{d}\mathbf{A}$

$\mu = M/\gamma$ $\qquad$ $K = (8m_0M)^{-1/2}J$

Consider Instead:

$\Lambda = p^3\,\Psi = p^3 \oint \mathrm{d}s/B$ $\qquad$ $\Phi = \oint \mathbf{B} \cdot \mathrm{d}\mathbf{A}$

HAMILTONIAN FUNCTION

$$H = [p^2c^2 + m_0{}^2c^4]^{1/2} - m_0c^2 - q\mu_E(\Omega/L\boldsymbol{a}) + qV(L, \varphi; t)$$

$$p^2 = 2m_0MB_0 \csc^2\alpha_0 \qquad \text{(at constant } K\text{)}$$

$$p^2 = (\Lambda/\Psi)^{2/3} \qquad \text{(at constant } \Lambda\text{)}$$

MAGNETIC FIELD MODEL

$$\mathbf{B} = -\mu_E \nabla[(1/r^2)\cos\theta - (r/b^3)\cos\theta]$$

$$r = L\boldsymbol{a}[1 + (r^3/2b^3)]\sin^2\theta$$

SIMPLIFYING APPROXIMATION

. . . for particles in strong pitch-angle diffusion [*Schulz*, *JGR*, *103*, 61–67, 1998]:

$$\oint ds/B \approx (L^4 \boldsymbol{a}^4/\mu_E)\{(32/35) - [2.045 + 1.045(r_0/b)^3 + 0.095(r_0/b)^6 + 0.075(r_0/b)^9\} \ln[1 - (r_0/b)^3] ,$$

where $\boldsymbol{a} = 1\ R_E$, μ_E = geomagnetic dipole moment, and r_0 = equatorial radius of magnetic shell:

$$r_0 = L\boldsymbol{a}\,[1 + 0.5(r_0/b)^3]$$

SUMMARY

Simulation results show some similarity to (and some differences from) the PIXIE and UVI data.

Our simulations do not yet include some important features (e.g., parallel electric fields) and their effects (e.g., discrete auroral arcs).

Possible refinements:

- Improve upon the AMIE field model;
- Take better account of MLT asymmetries in ambient magnetic field;
- Take account of ring current's magnetic field to make the simulations self-consistent.