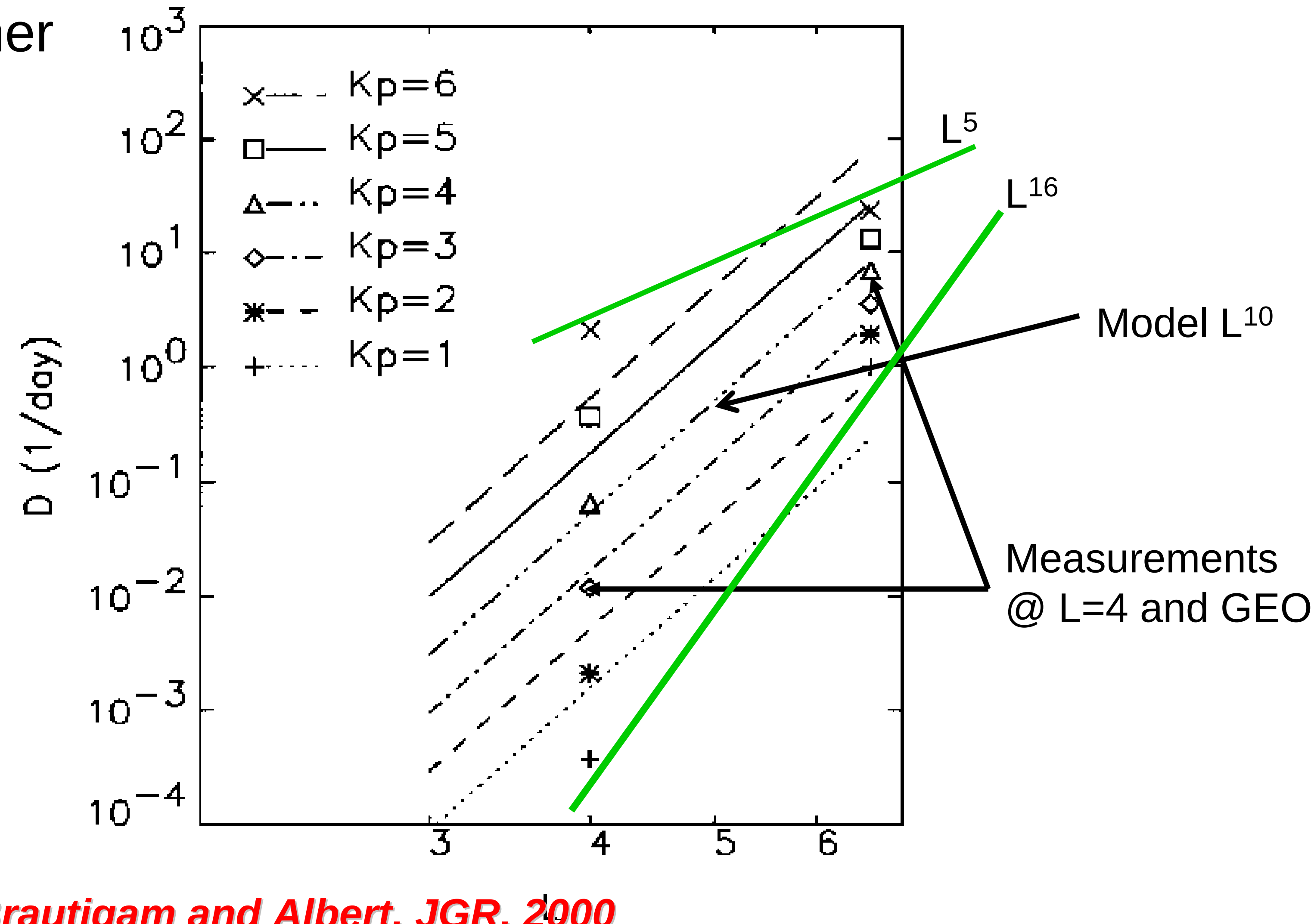
9. Combining models and observations in the inner magnetosphere (Hudson & Elkington)

- **Solicited Presentations:**
- Daniel Boscher: Contribution of data assimilation to the radiation belt dynamics
- Chia-Lin Huang: Quantifying ULF wave properties in the inner magnetosphere
- Sasha Ukhorskiy: Mechanisms and properties of radial transport in the outer radiation belt
- **Brief presentations:**
- Scot Elkington: Energetic particle dynamics during January 1995 geomagnetic strom
- Shri Kanekal: Testing models of energization and loss of relativistic electrons: in situ observations and particle transport
- Mike Liemohn: Cool results from RAM→HEIDI

Uncertainty on radial diffusion coefficients

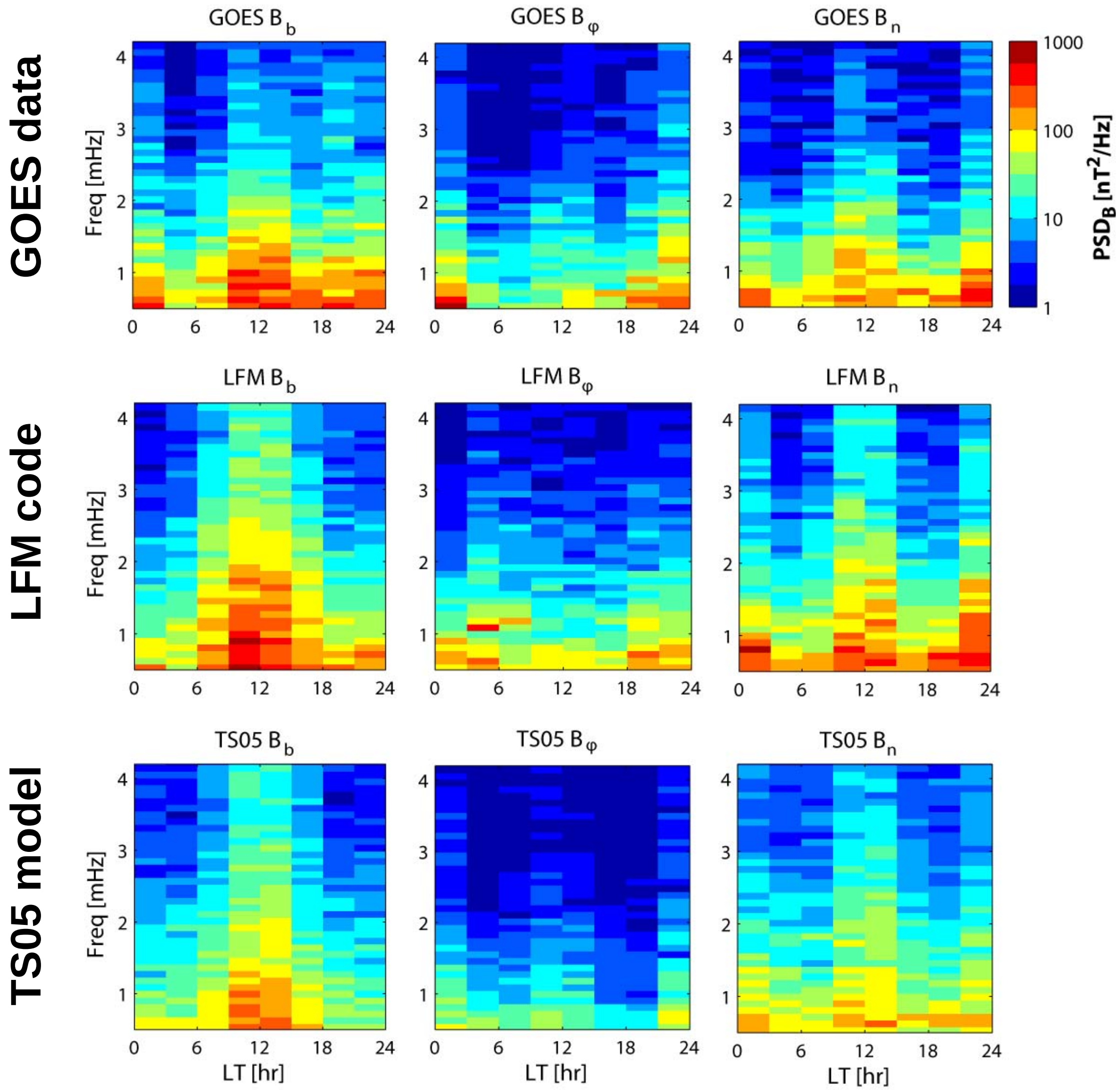
D. Boucher



from Brautigam and Albert, JGR, 2000

And it is just statistical measurements and a model: in fact, radial diffusion is different from one storm to another

ULF Wave Prediction of GOES, LFM &TS05

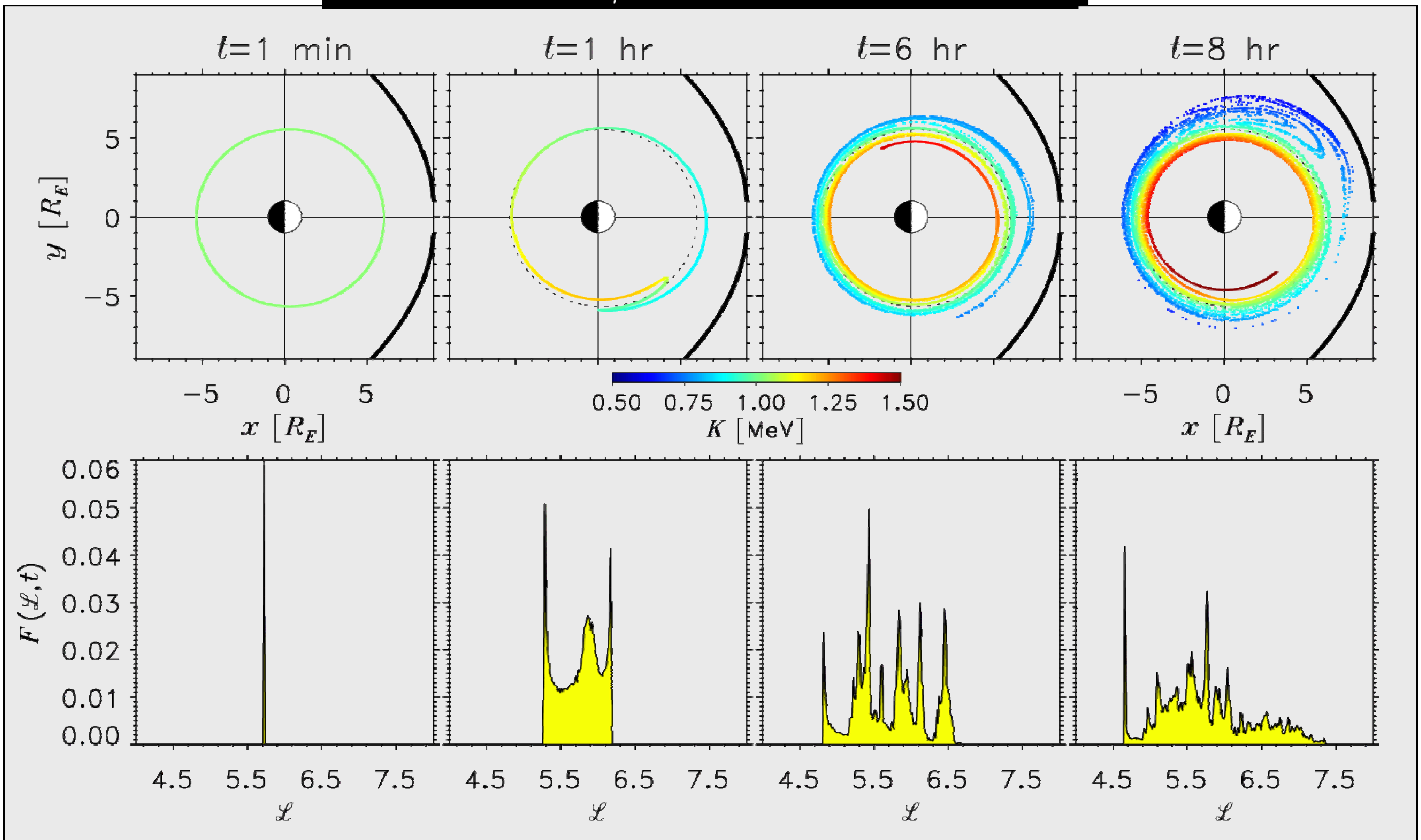


- Feb-Apr 1996: typical solar wind condition
- LFM wave prediction is much better than expected
- TS05 underestimates the wave power
- **Next step:** use LFM's wave fields during non-storm time to study ULF wave effects on radiation belt electrons

C-L. Huang

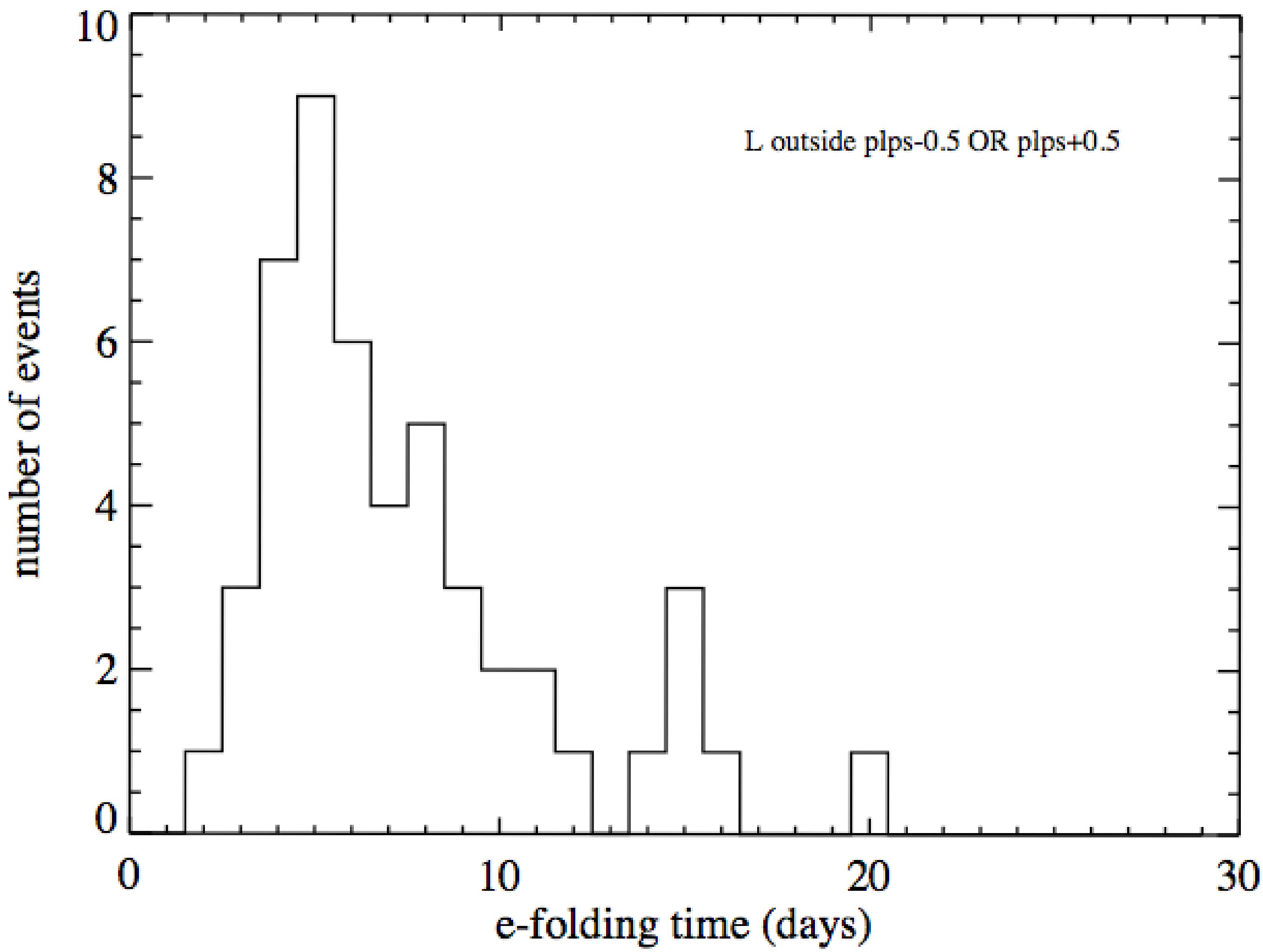
S. Ukhorskiy

$$b_z^{rms} = 2.5 \text{ nT}, \ E_\varphi^{rms} = 0.5 \text{ mV/m}$$



$$\langle\langle(\Delta\mathcal{L}(t))^2\rangle\rangle = \int (\Delta\mathcal{L})^2 F(\mathcal{L},t)d\mathcal{L} = \frac{1}{N_p}\sum_{k=1}^{N_p}(\mathcal{L}_k(t) - \mathcal{L}_0)^2 = 2D_{\mathcal{L}\mathcal{L}}t$$

SAMPEX and HEO observations

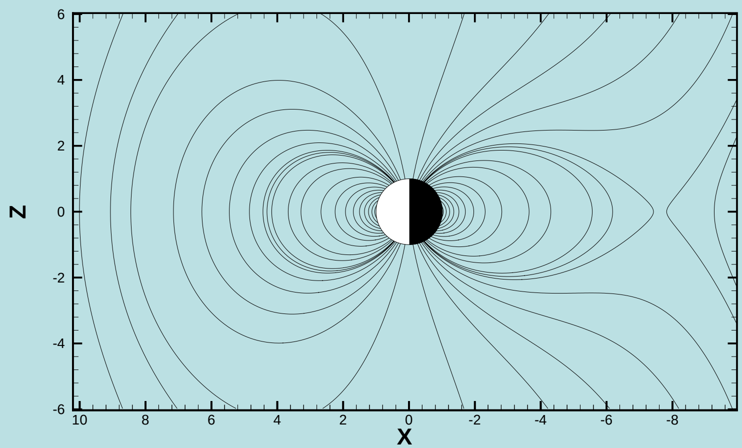


S. Kanekal

U. Alberta covariant ULF model

Rankin, Kabin, and co-workers at University of Alberta have devised a means of self-consistently calculating wave polarizations and frequencies in a model magnetic field.

Generalized field model:



$$\alpha = \frac{B_0}{r}\sin^2\theta - \frac{1}{2}r^2 b_1(1+b_2\cos\phi)\sin^2\theta$$

$$\beta = \phi$$

Eigenmode equations:

$$\frac{1}{\sqrt{g}}\frac{\partial\,\delta B_2}{\partial\mu} = \frac{1}{v_A^2}\left(g^{11}\omega\delta E_1 + g^{12}\omega\delta E_2\right)$$

$$\frac{1}{\sqrt{g}}\frac{\partial\,\delta B_1}{\partial\mu} = \frac{1}{v_A^2}\left(g^{21}\omega\delta E_1 + g^{22}\omega\delta E_2\right)$$

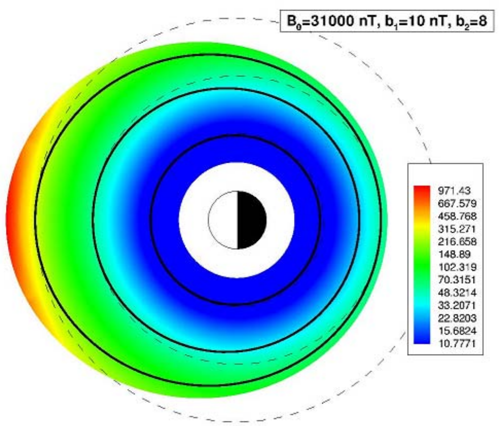
$$\frac{1}{\sqrt{g}}\frac{\partial\,\delta E_1}{\partial\mu} = -\left(g^{12}\omega\delta B_1 + g^{22}\omega\delta B_2\right)$$

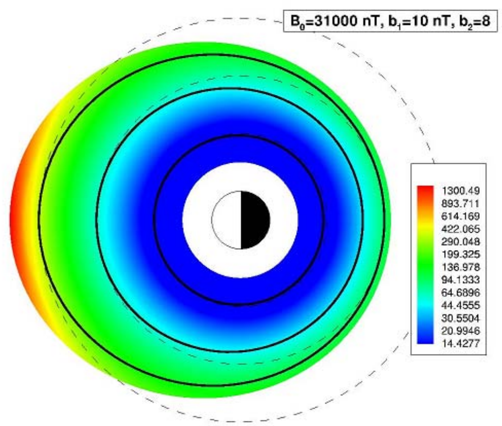
$$\frac{1}{\sqrt{g}}\frac{\partial\,\delta E_2}{\partial\mu} = \left(g^{11}\omega\delta B_1 + g^{12}\omega\delta B_2\right)$$

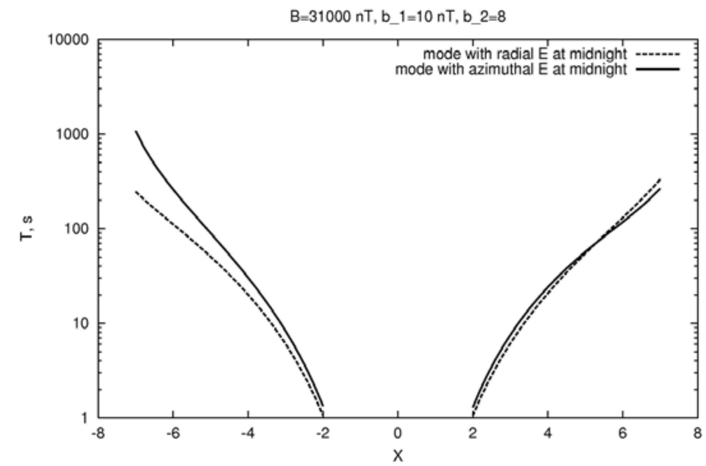
Density: $\rho = \rho_{eq}(r/5)^{-4}$

Rankin et al., *JGR 27,* 2000; Rankin et al., *JGR 110*, 2005; Kabin et al., *PSS 33*, 2007a; Kabin et al., *Ann. Geophys 25*, 2007b

ULF wave properties in the covariant model







Important differences from the simplified field model:

- Drift paths not along constant frequency contours.
- Wave polarization changes with radial distance and azimuthal location.

S. Elkington