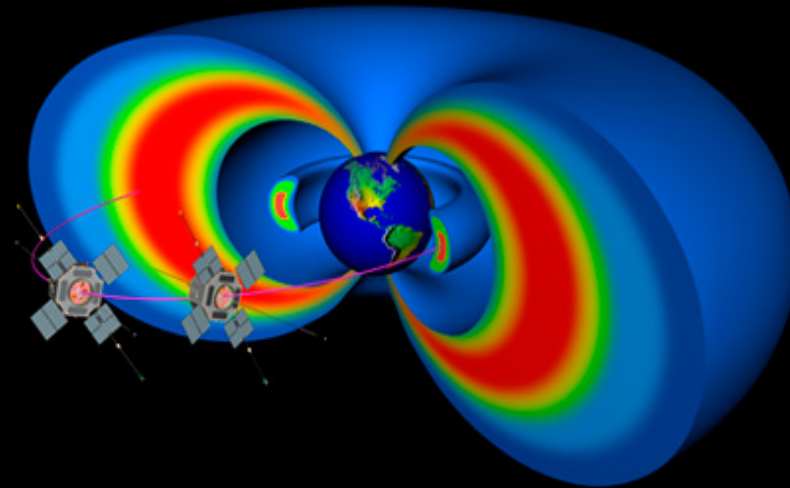




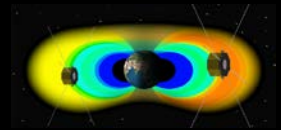
Recent Results from the Electric and Magnetic Field Instrument Suite and Integrated Science (EMFISIS) on the Van Allen Probes

C. A. Kletzing

The University of Iowa



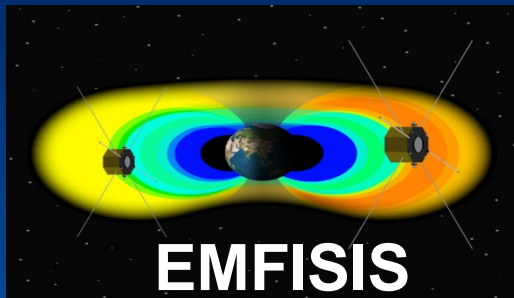
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Acknowledgements

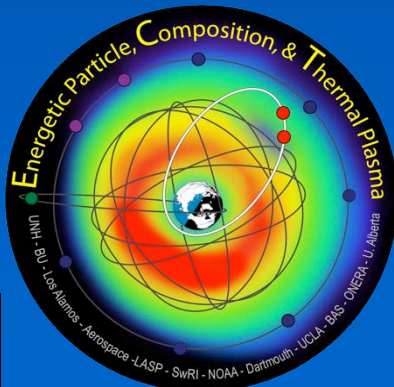
We would like to thank the Van Allen Probes instrument teams contributing to this talk:



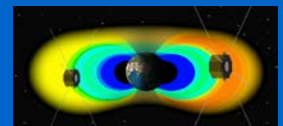
C. A. Kletzing, W. S. Kurth, M. Acuna, R. J. MacDowall, R. B. Torbert, T. Averkamp, D. Bodet, S. R. Bounds, M. Chutter, J. Connerney, D. Crawford, J. Dolan, R. Dvorsky, G. Hospodarsky, J. Howard, V. Jordanova, R. Johnson, D. Kirchner, B. Mokrzycki, G. Needell, J. Odom, D. Mark, J. Phillips, C. Piker, S. Remington, O. Santolik, R. Schnurr, D. Sheppard, C. W. Smith, R. M. Thorne, J. Tyler, and the extended Van Allen Probes EMFISIS team



John Wygant, Cynthia Cattell, John Bonnell, Forrest Mozer, Chris Chaston, Stuart Bale, Robert Ergun, Daniel Baker, Xin-Lin Li, Mary Hudson, Robert Strangeway, John Foster, Jay Albert, Ian Mann, Eric Donovan, John Dombek, Chris Cully, Volodya Krasnosselskikh, David Malaspina, Guanqing Yan, Aaron Breneman, Jianbao Tao, Kris Kersten, Xiangwei Tang, Thiago Brit, Zhao Li, and the extended EFW team.



Harlan Spence, Geoff Reeves, Herb Funsten, Bern Blake, Dan Baker, Richard Thorne, Anthony Chan, Jim Clemmons, Scot Elkington, Joe Fennell, Reiner Friedel, Jerry Goldstein, Mike Henderson, Mary Hudson, Jörg-Micha Jahn, Vania Jordanova, Shri Kanekal, Brian Larsen, Xinlin Li, Liz MacDonald, Paul O'Brien, Ruth Skoug, Michelle Thomsen, and the extended RBSP-ECT Science Team





EMFISIS Data Example

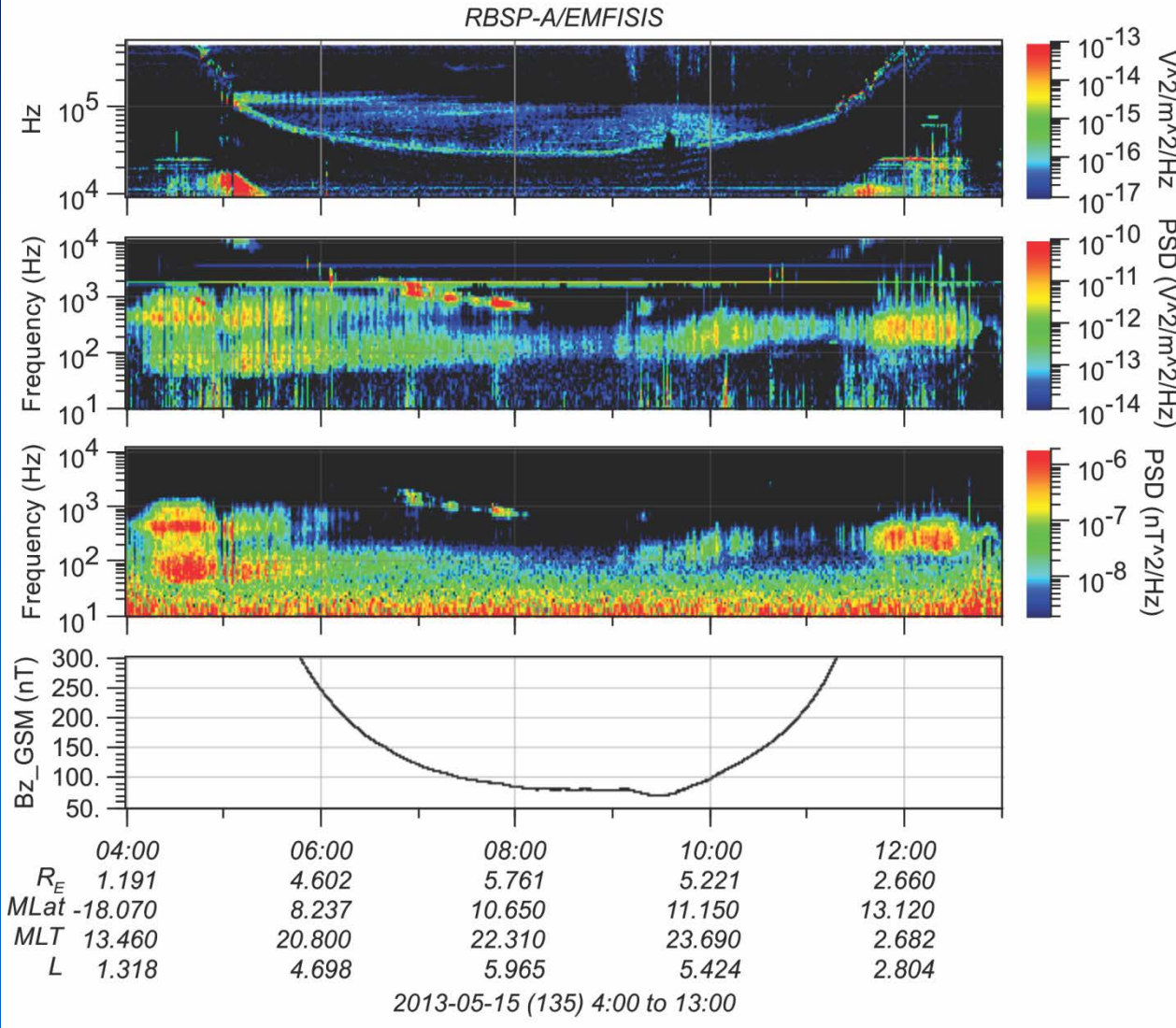
(5-15-2013)

E-HFR

WFR E

WFR B

DC
MAG

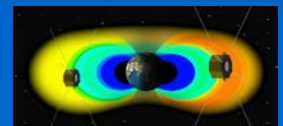


HFR (single channel):
10 kHz-400 kHz

Vector E:
10 Hz-12 kHz

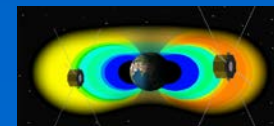
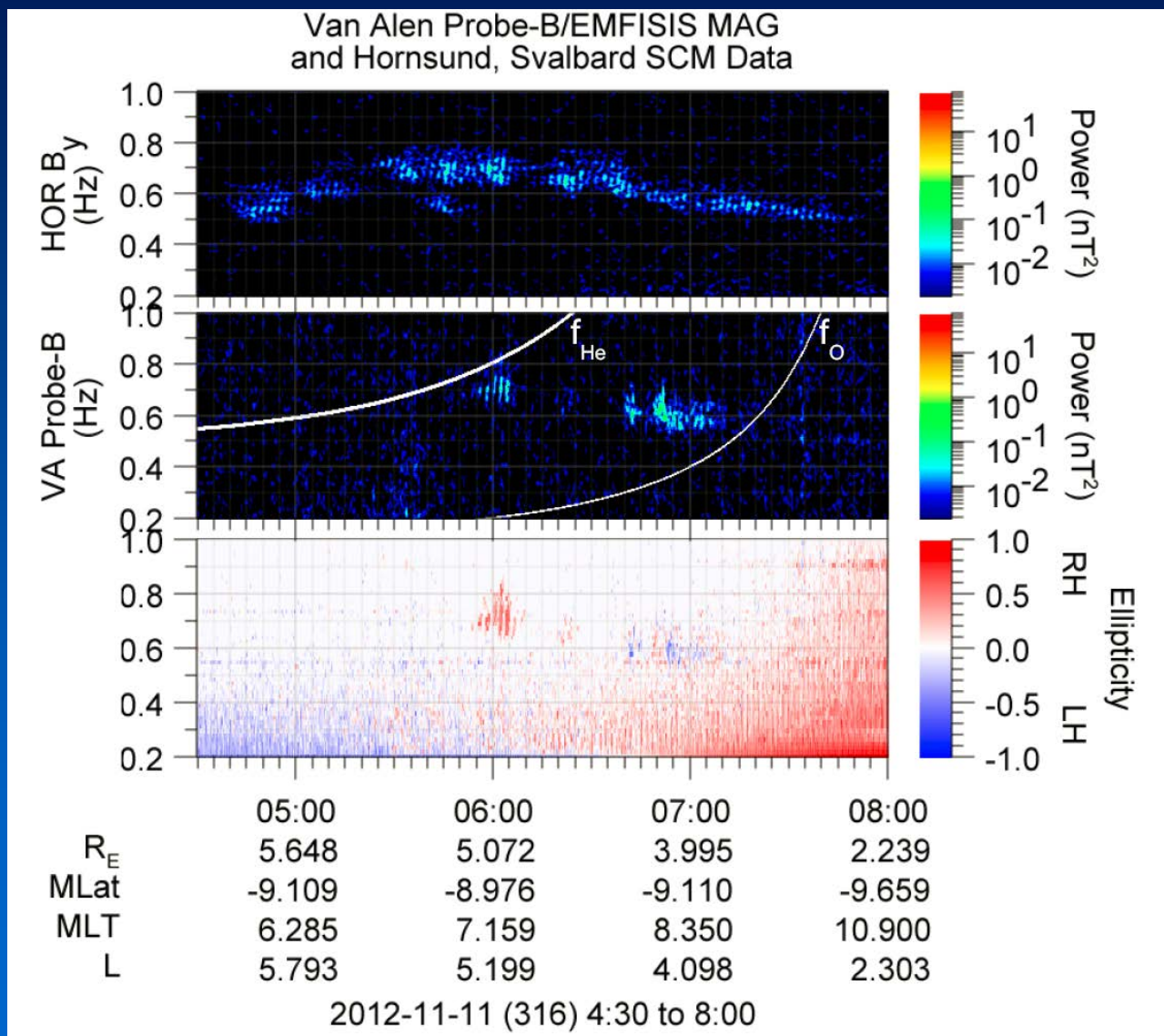
Vector B:
10 Hz-12 kHz

Vector B:
0-30 Hz



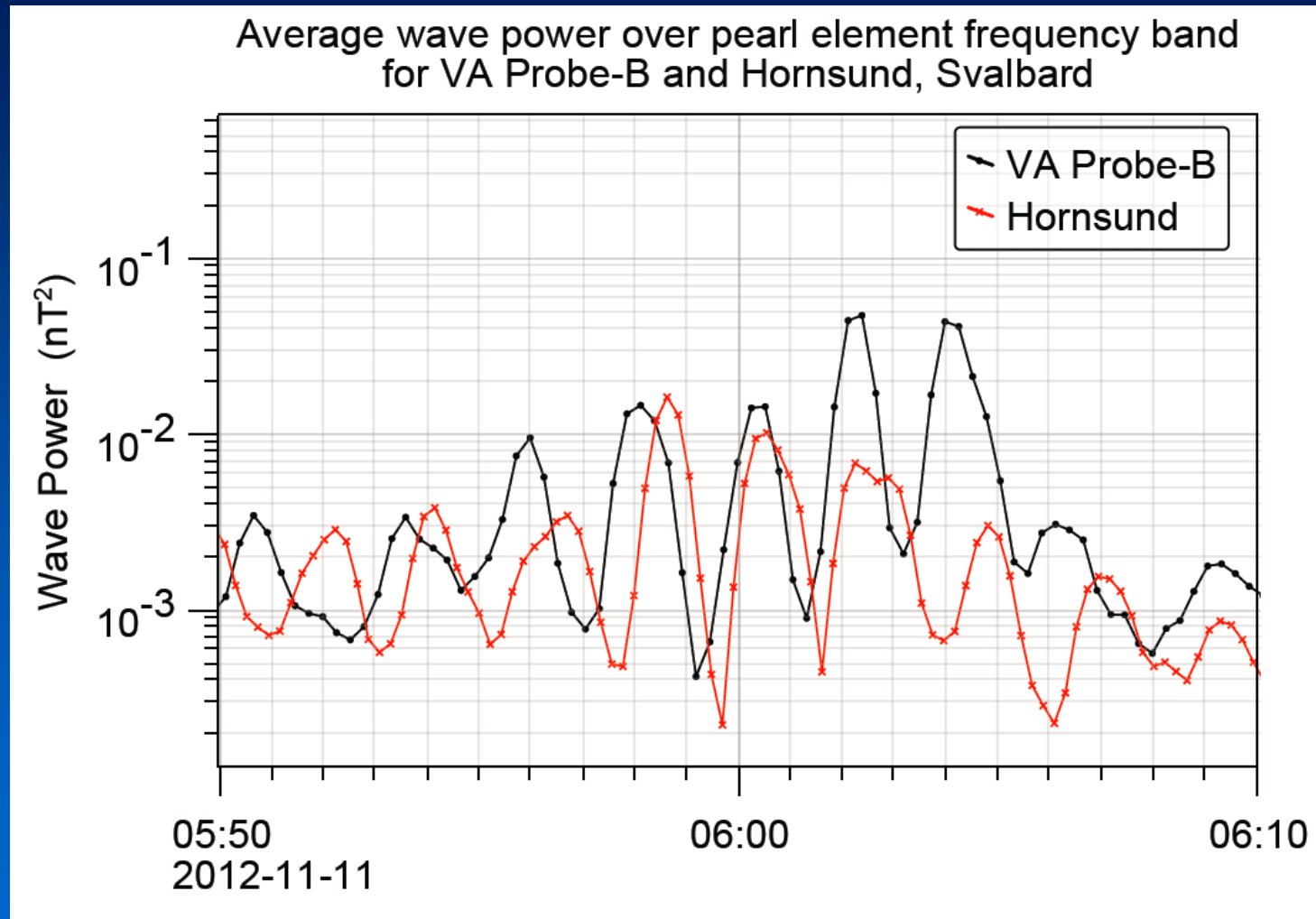


Pc1 Pearls





Ground-Space Correlation

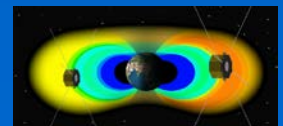


Paulsson, et al, 2014



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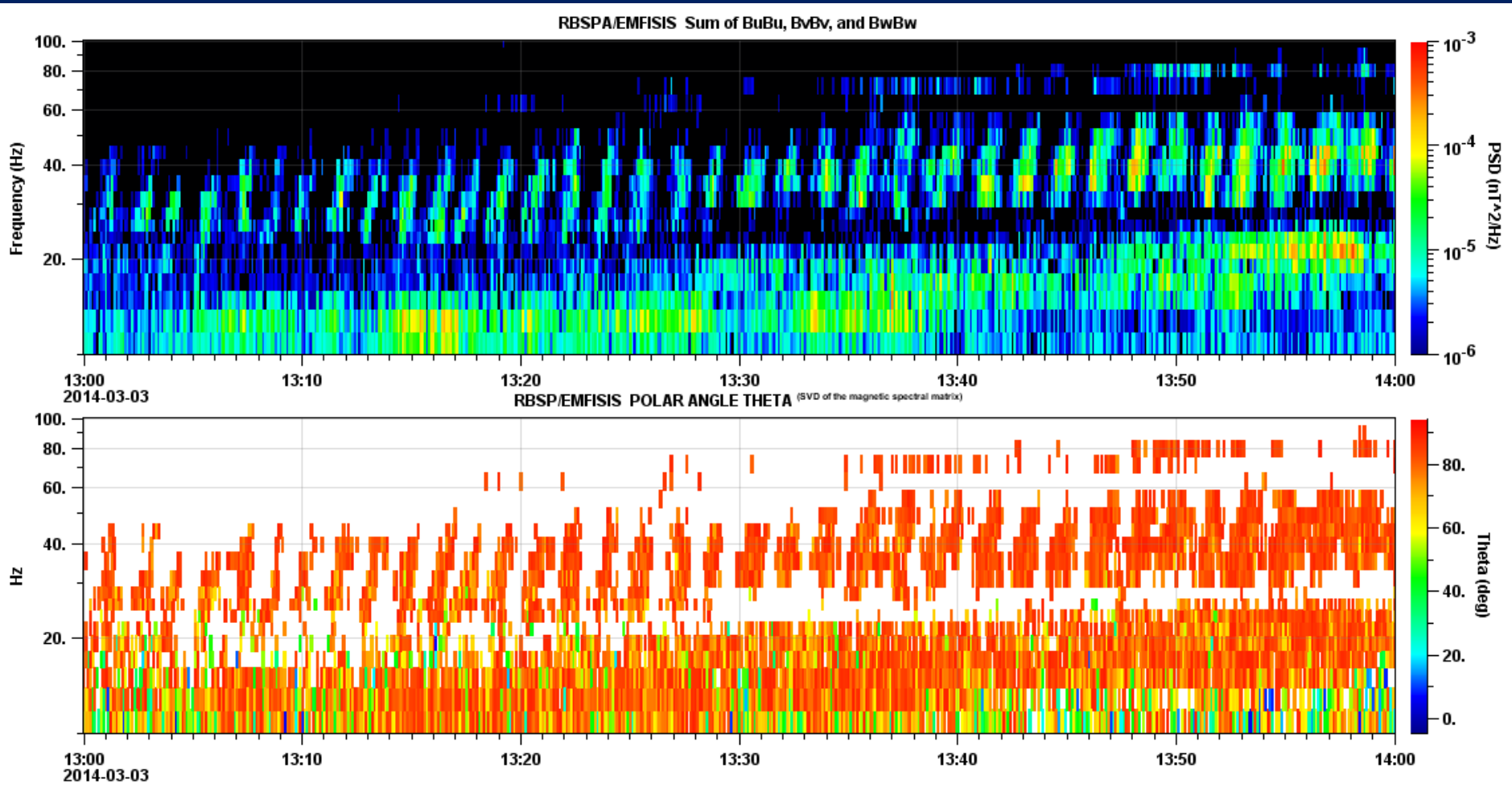
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Rising Tone Magnetosonic Waves

From March 3, 2014.

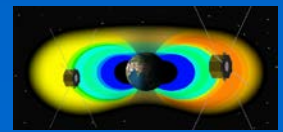


From S.Boardsen, GSFC and G. Hospodaarsky, UI



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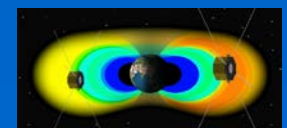
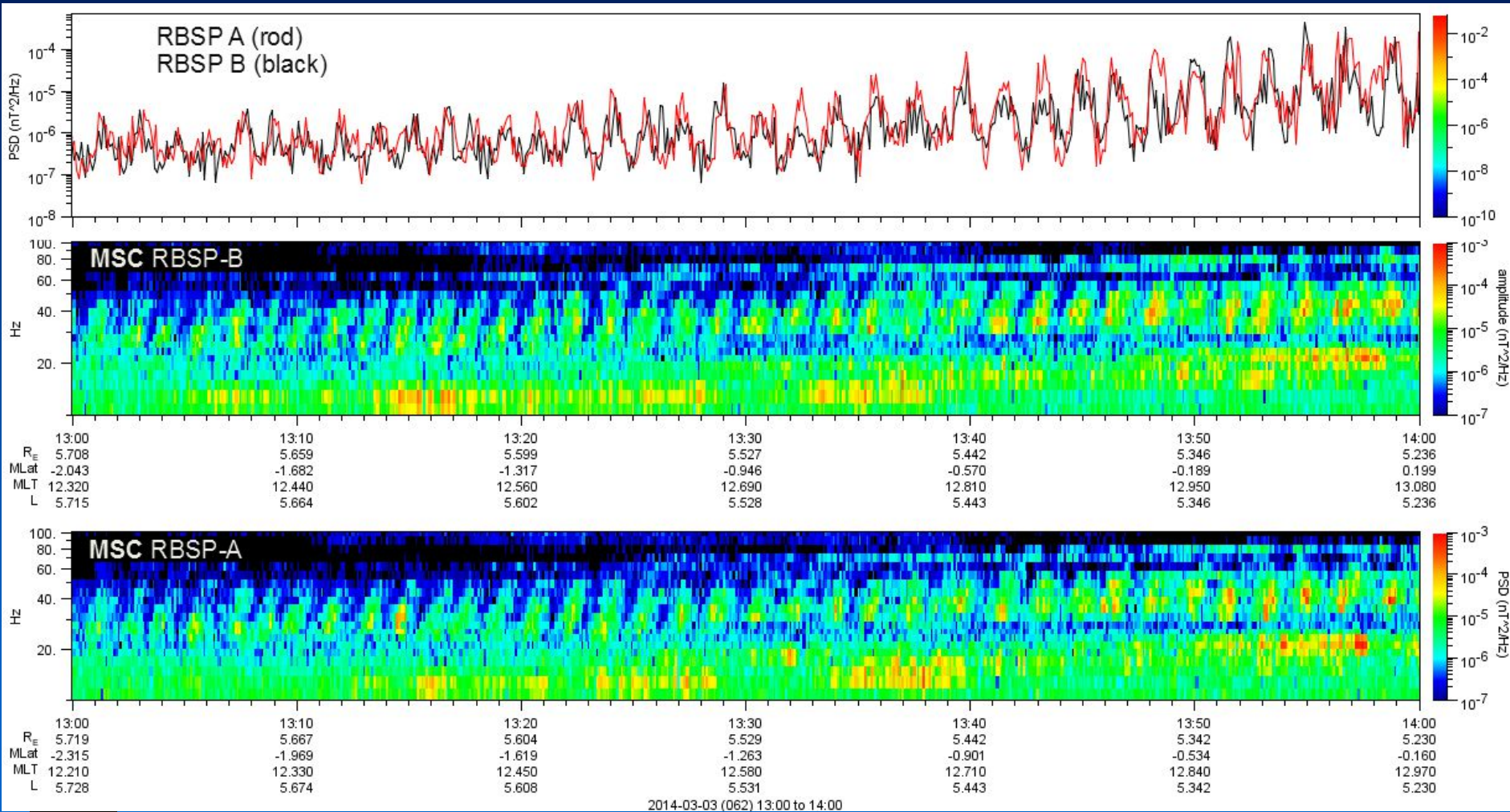
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Both Spacecraft

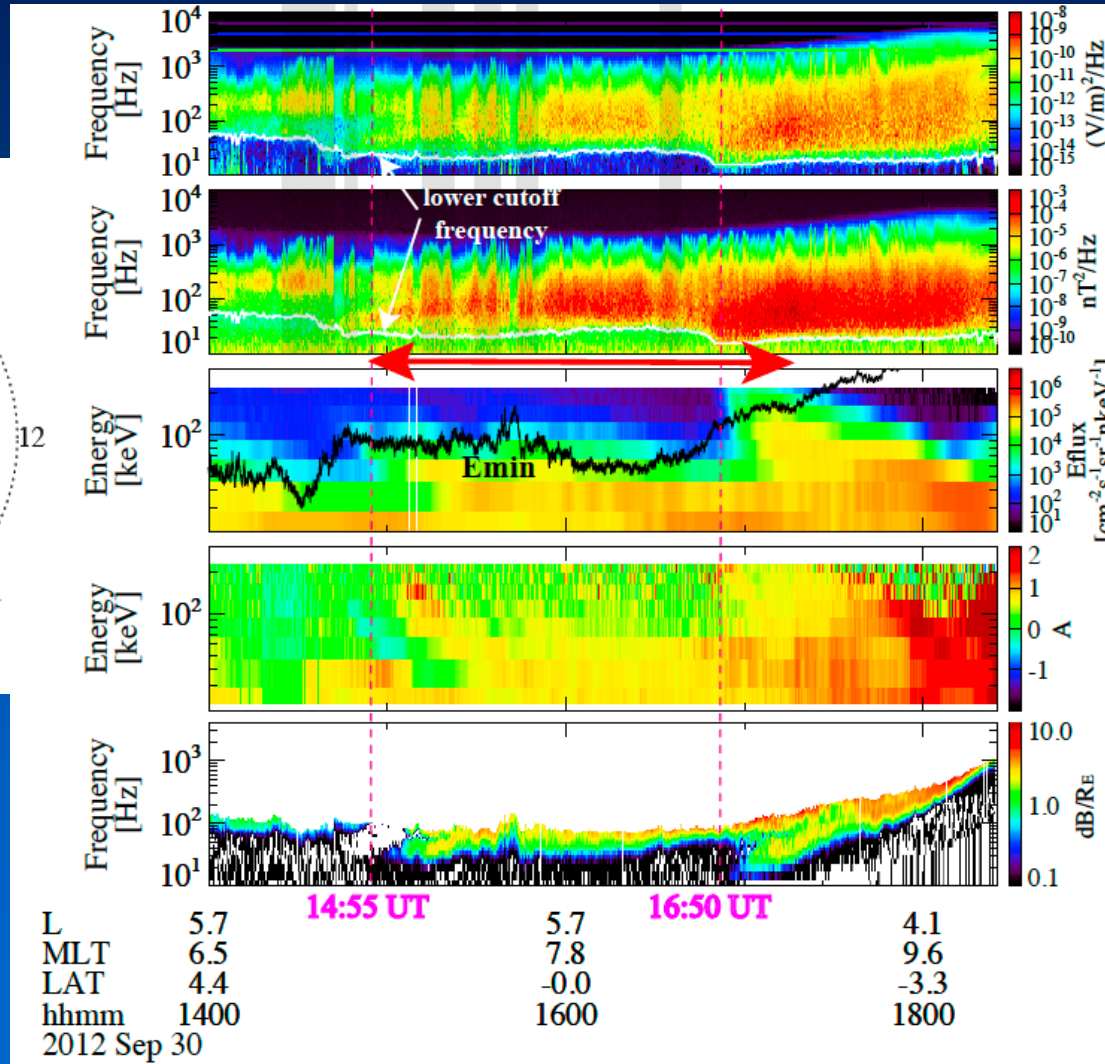
From March 3, 2014





Hiss Growth

RBSP-A shows growth at very low frequencies



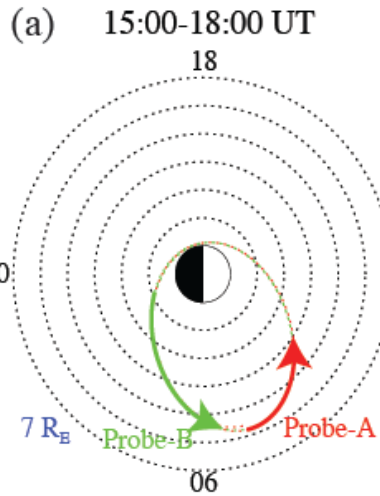
E

B

MagEIS
Electrons

Anisotropy

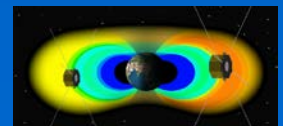
Growth
rate



From
Li, et al.
2013

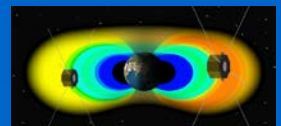
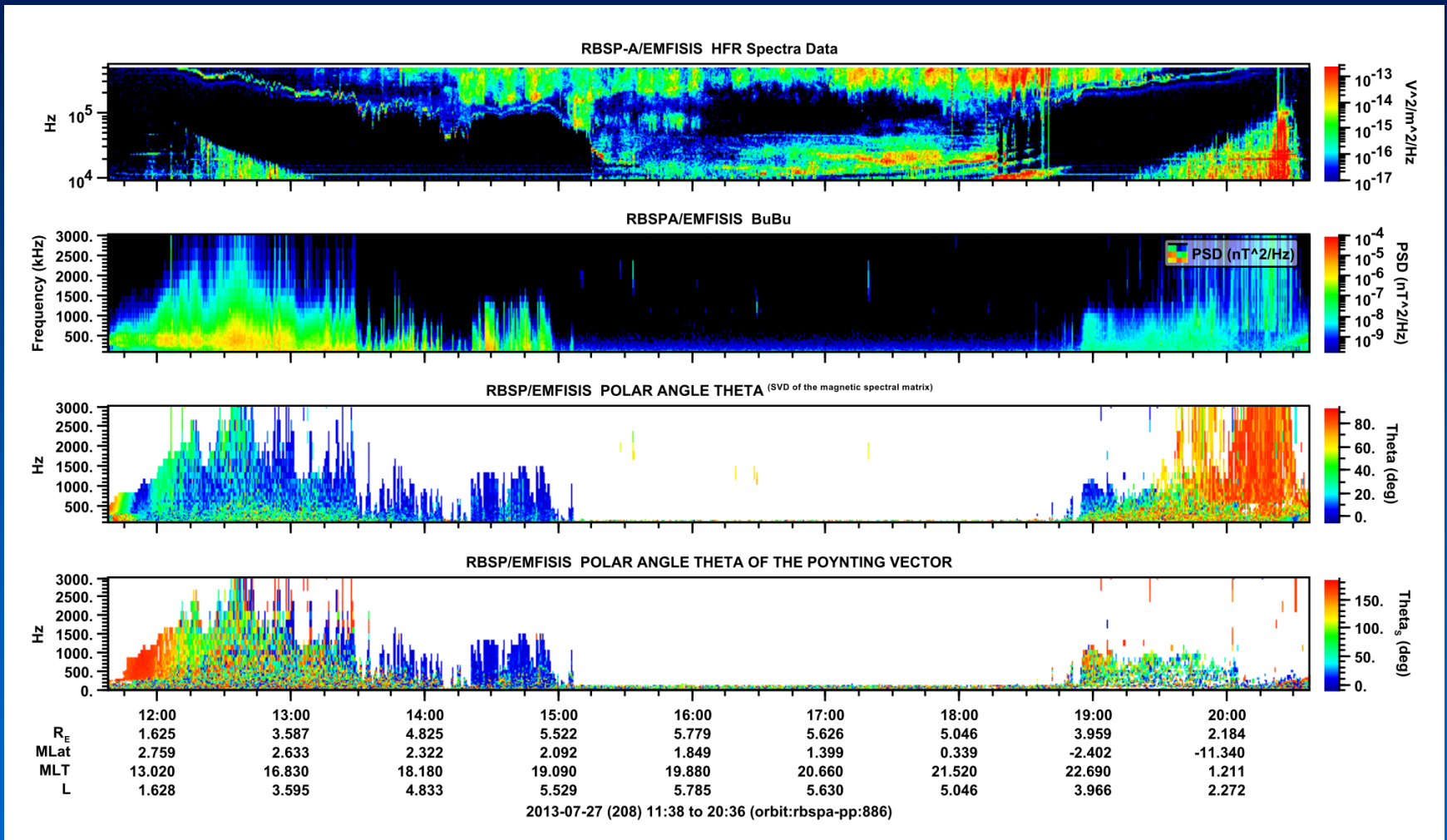


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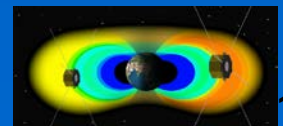
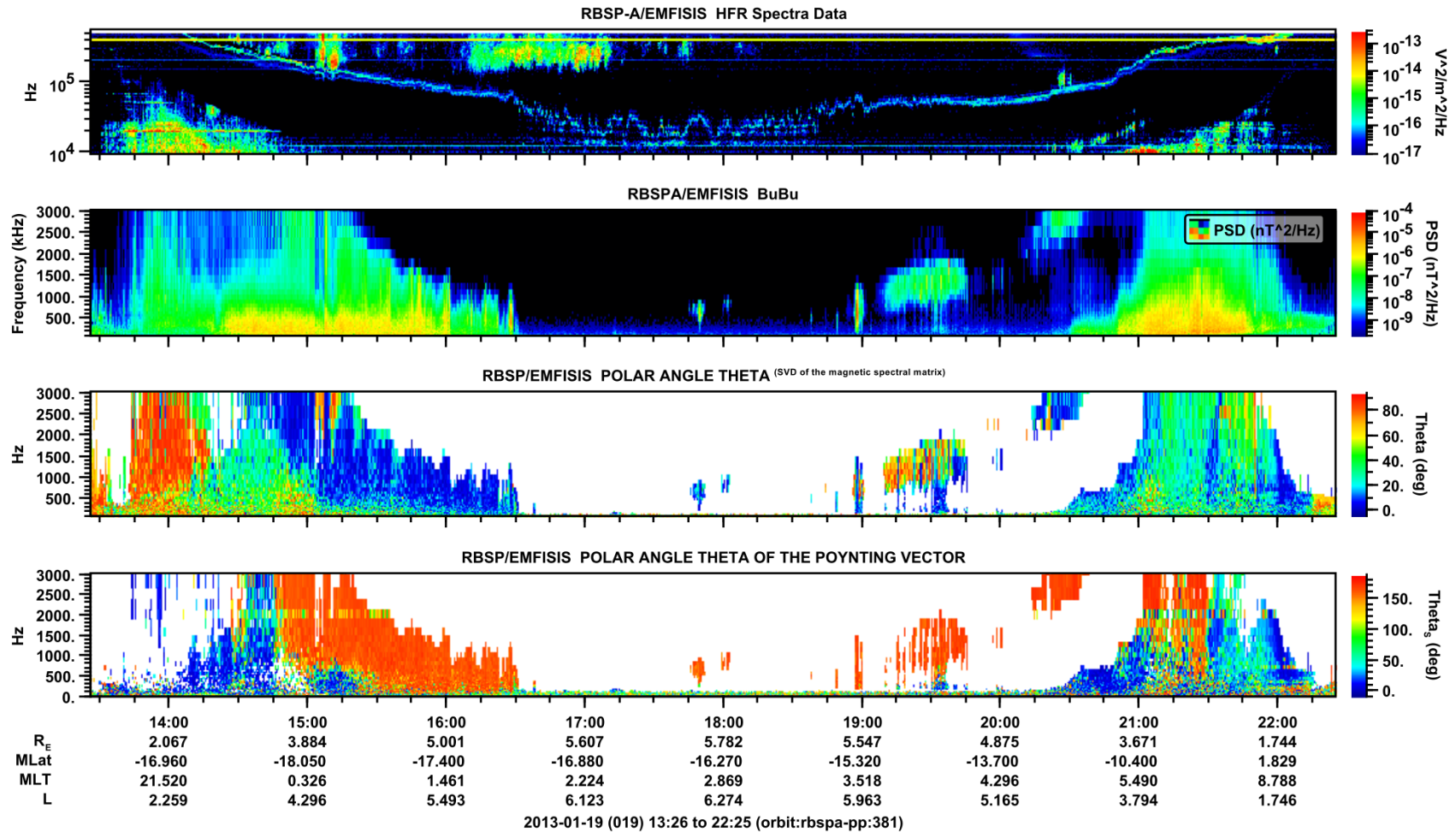


Northward Away Case



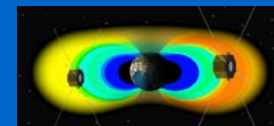
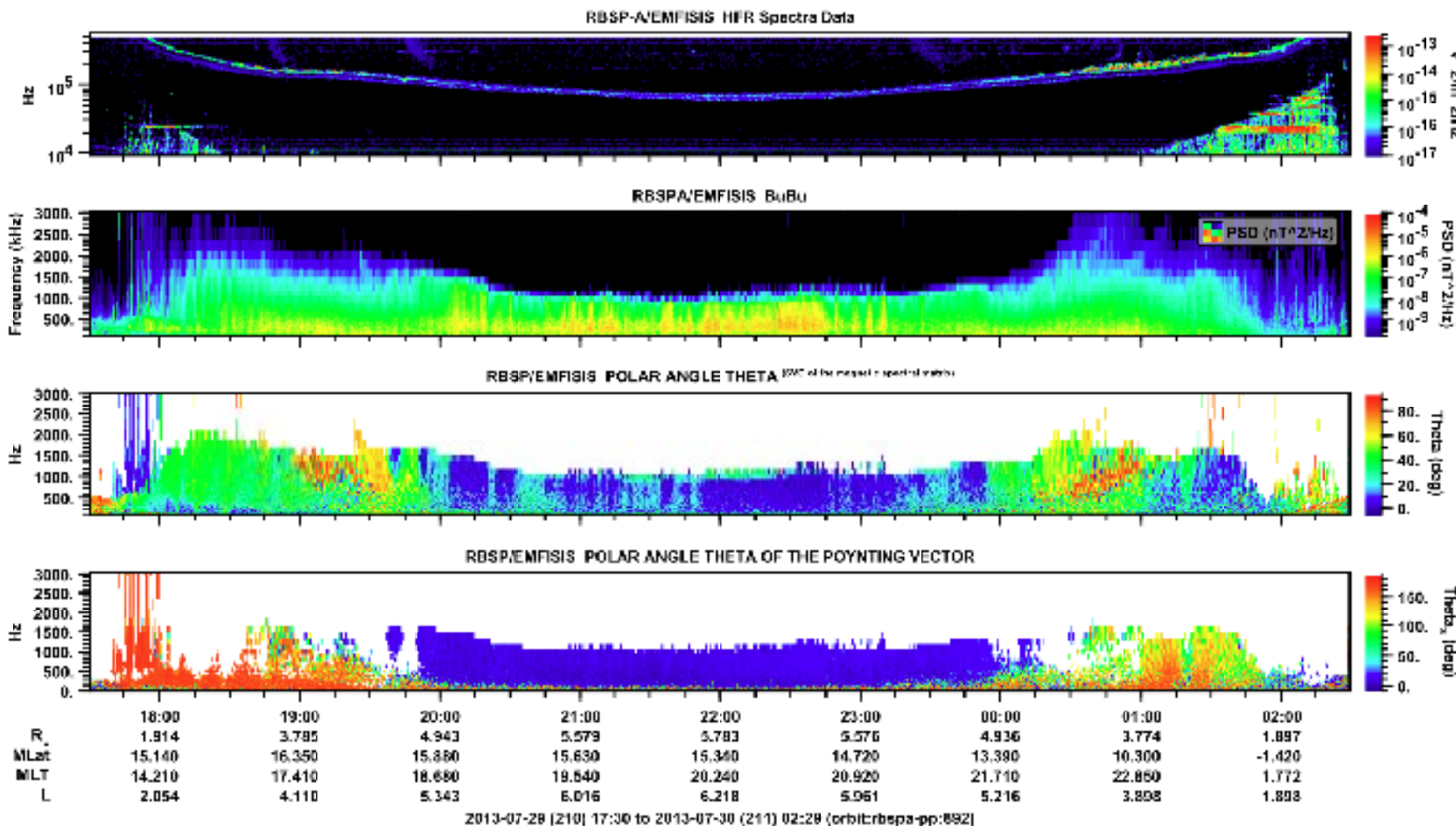


Southward Away Case



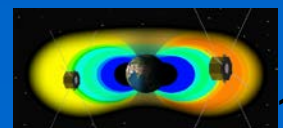
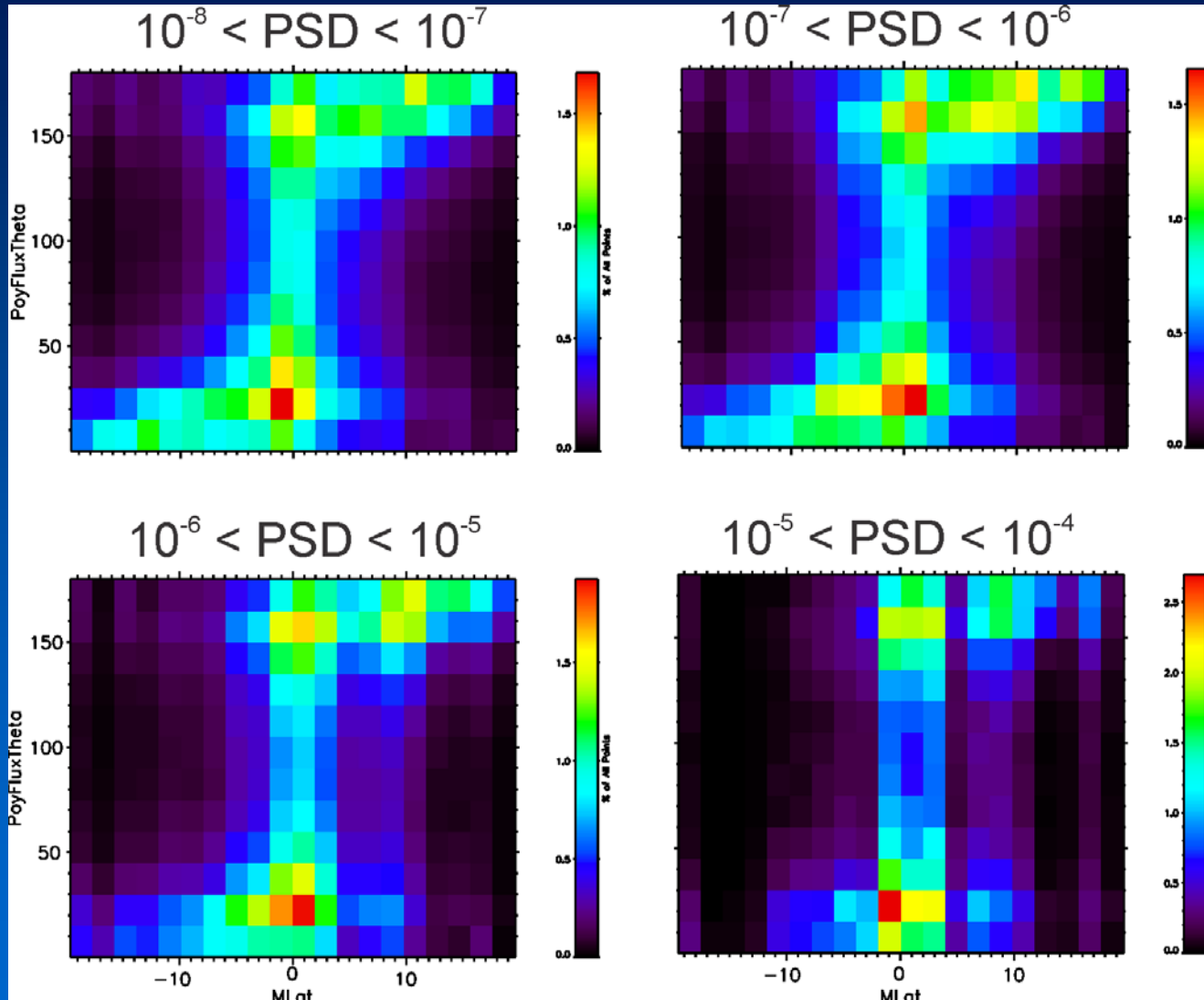


Skimming Plasmopause Case





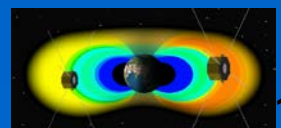
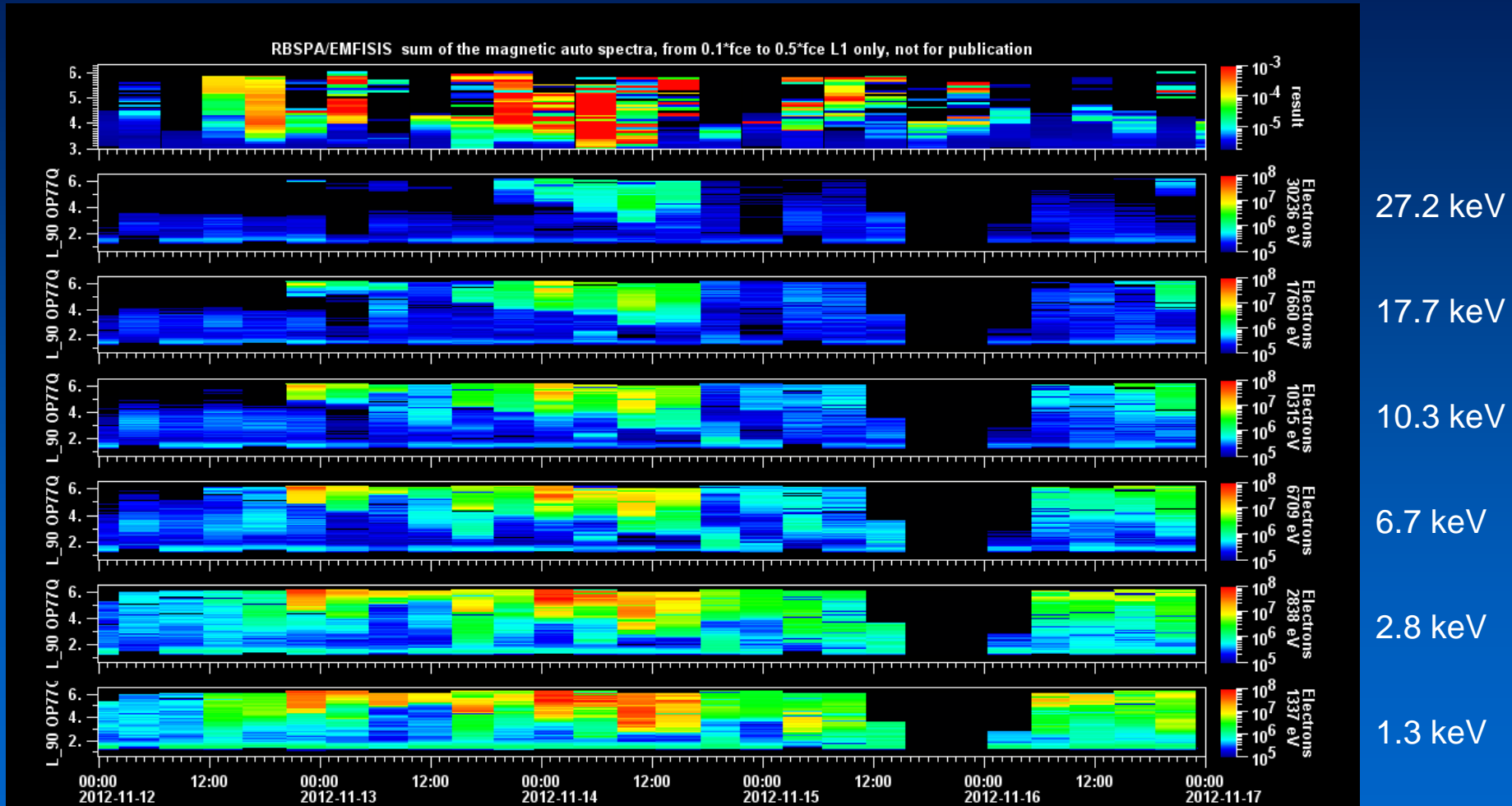
Poynting Flex vs Mlat





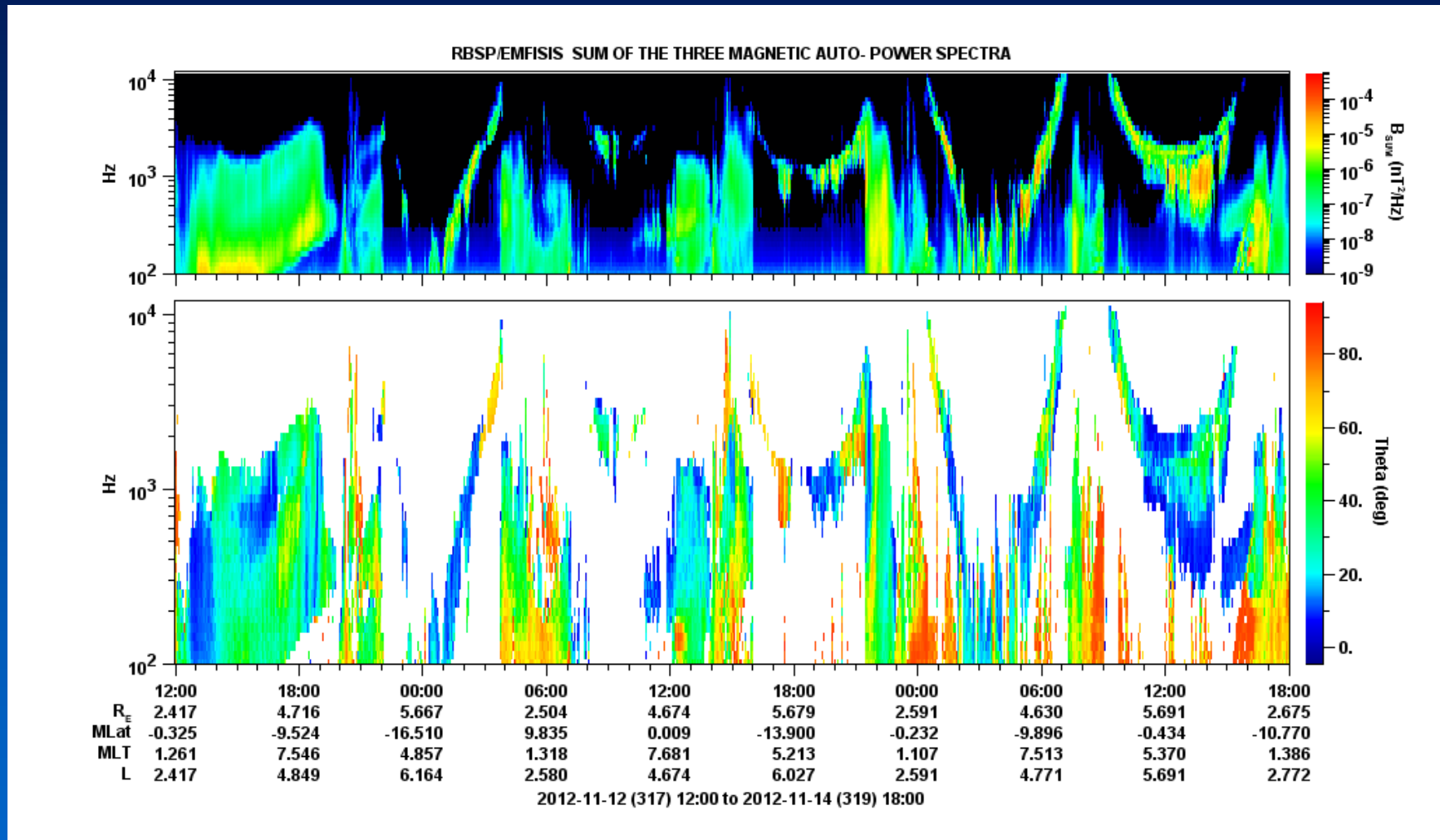
Electrons Producing Chorus?

Electrons with energy above ~20 keV don't seem well-correlated

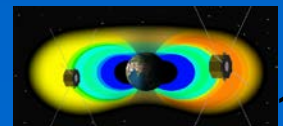




Wave Normal Direction



Wave normal can be quite oblique





Wave-particle interaction

Parallel propagation, non-relativistic

Whistler mode
Dispersion relation:

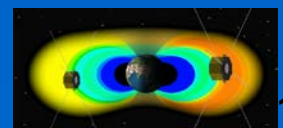
$$\frac{k^2 c^2}{\omega^2} = 1 + \frac{\omega_{pe}^2}{\omega(\omega_{ce} \cos\theta - \omega)}$$

Resonance
Condition:

$$\omega - k_{||} v_{||} = \omega_{ce}$$

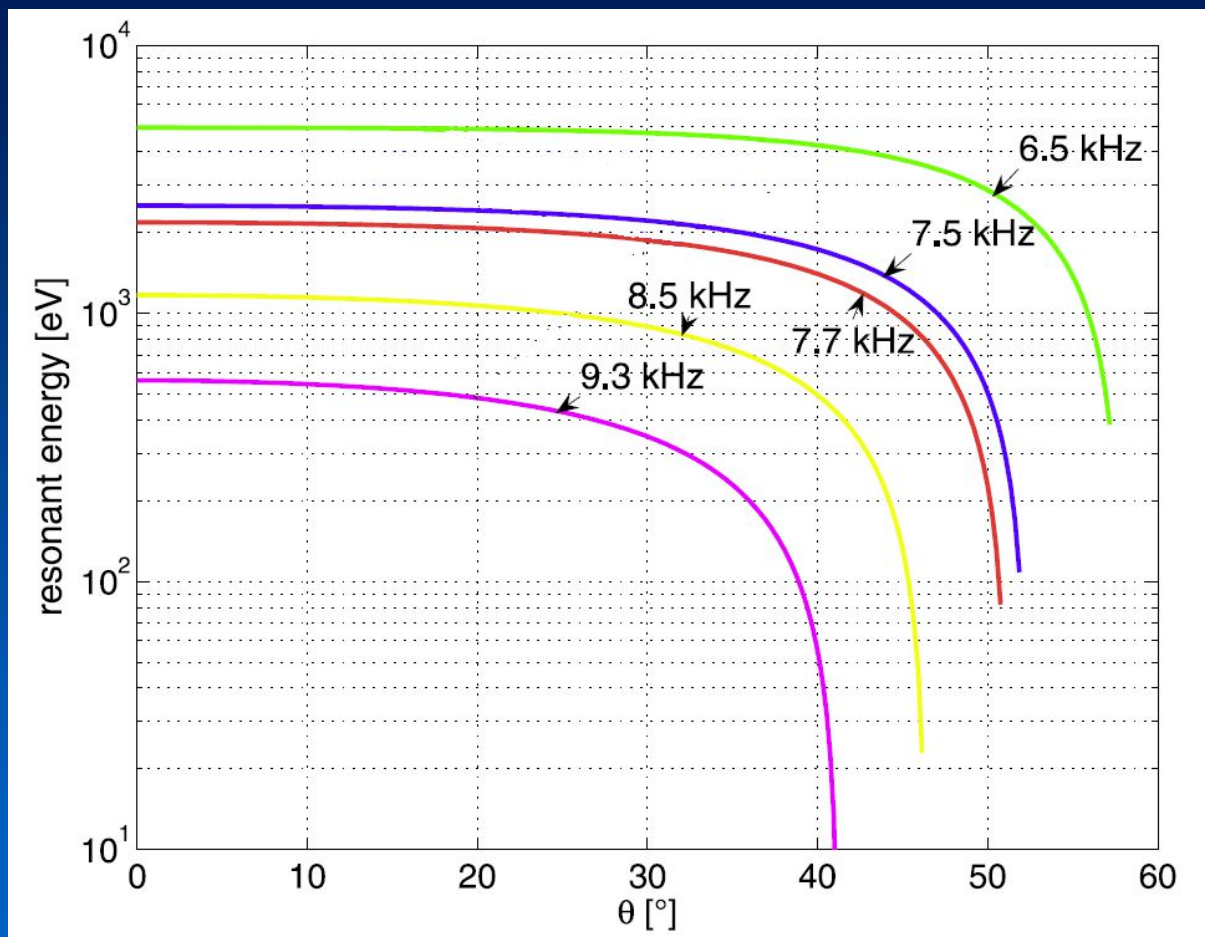
Resonant
Energy:

$$\frac{2E}{mc^2} = \frac{(\omega_{ce} - \omega)^2 (\omega_{ce} \cos\theta - \omega)}{\omega \cos^2\theta (\omega \omega_{pe} \cos^2\theta - \omega^2 + \omega_{pe}^2)}$$

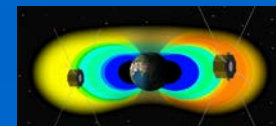




Wave Direction and Resonance

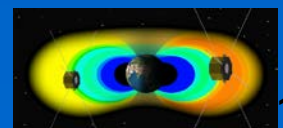
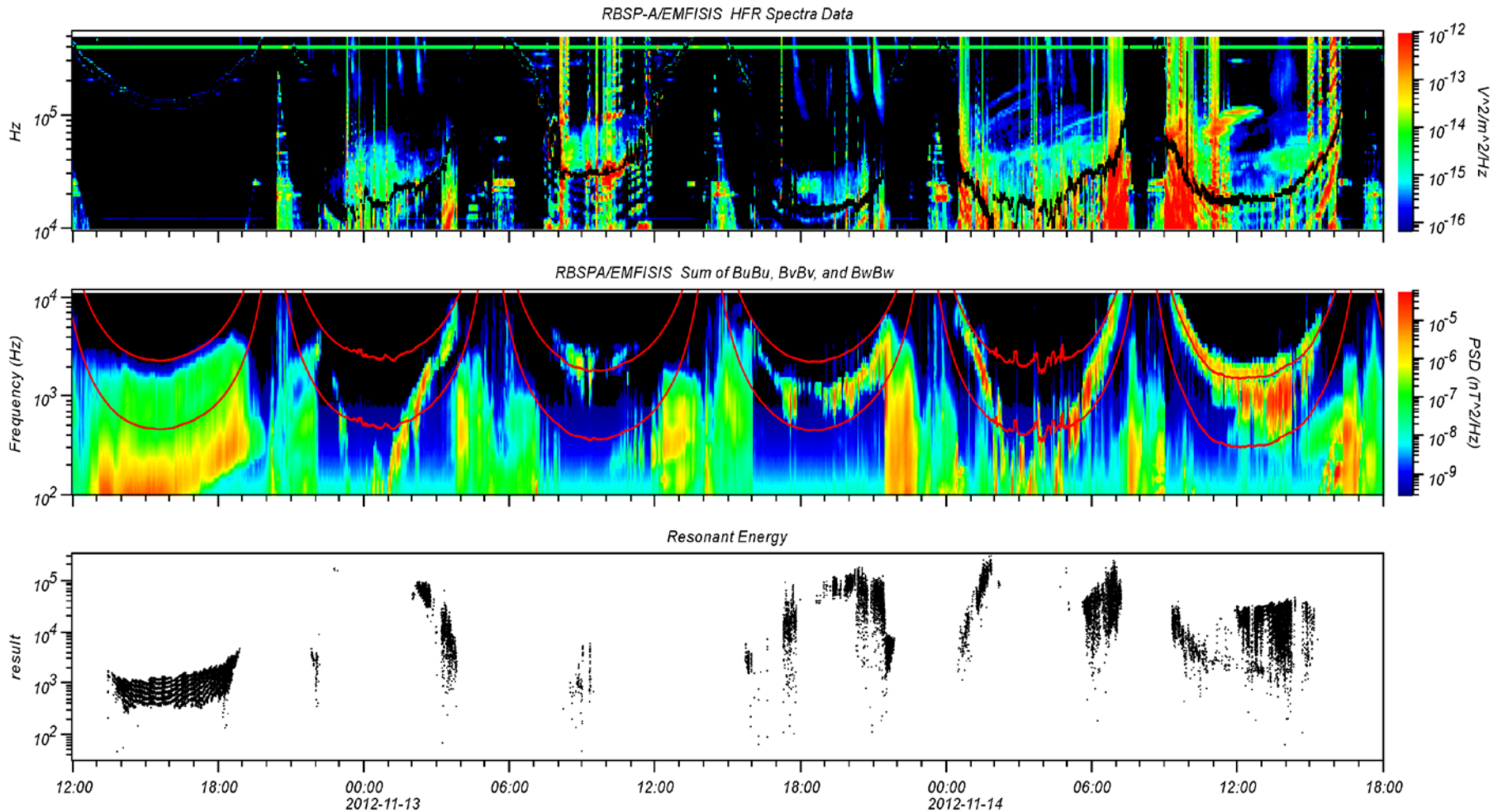


- Example resonance curves from Chum, et al. [2007].
- Oblique wave normal lowers resonance energy.





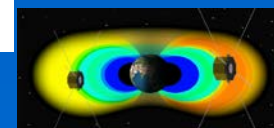
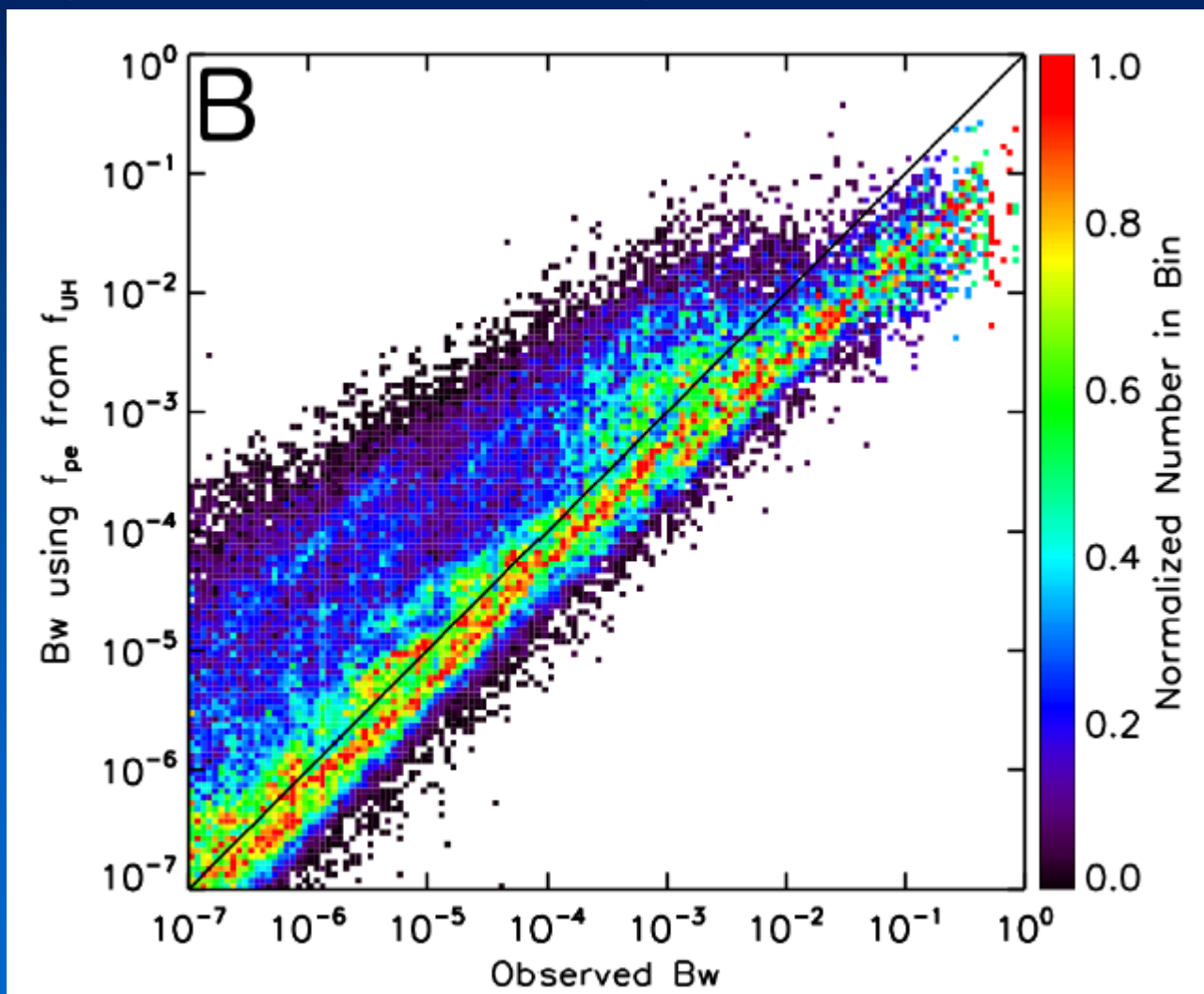
Electron Resonant Energy





Testing Cold Plasma Dispersion

Comparing measured wave magnetic field to calculated value.





Conclusions

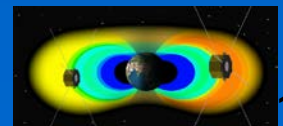
- Van Allen Probes continue to return outstanding data
- EMIC “Pearls” suggest structure is from generation region, not bouncing wave packets.
- Plasmaspheric hiss can be very low frequency.
- Poynting flux direction of plasmaspheric hiss suggests that most hiss is locally generated in the plasmasphere.
- Largest amplitude hiss, however, may not be locally generated.
- Chorus generation appears to be from electrons with energies less than 100 keV at most.
- Initial results show cold plasma theory generally works well.

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That's all folks!



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