

## Modulation of Lower Hybrid and ECH Waves by Ultra-low Frequency (ULF) Waves in the Earth's Magnetosphere

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ULF waves, with their characteristic periods ranging from a few seconds to several minutes, are known to interact with various plasma waves, including chorus wave and EMIC waves, which play a key role in particle acceleration and wave-particle interactions. In this study, we report for the first time the periodic modulation of lower hybrid waves by ULF waves, revealing a novel interaction that occurs near the troughs of ULF wave fields. At the same time, we observe the periodic excitation of ECH waves. The excitation and disappearance of these waves, confined to the troughs of the ULF waves, suggest a new mechanism of wave interaction. Additionally, the ULF waves are diagnosed as drift-mirror modes. These findings highlight the periodic coupling of ULF, lower hybrid, and ECH waves and provide new insights into their interaction dynamics in the magnetosphere.

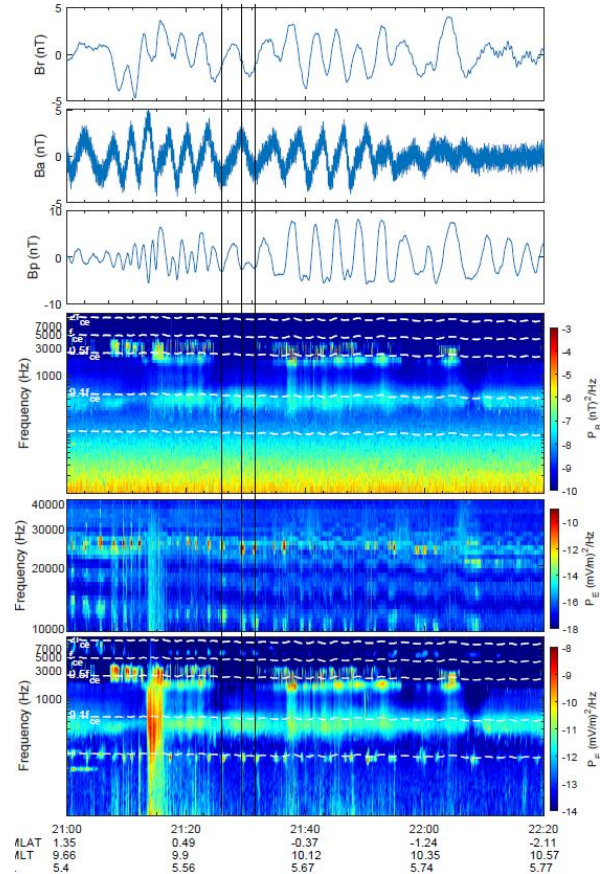


Figure 1 The first three panels show the three components of ULF waves in the mean field-aligned coordinate system. The subsequent three panels display high-frequency waves, specifically chorus, electron cyclotron harmonic (ECH), and lower hybrid waves, respectively.

### References

- [1] Li, L., Zhou, X.-Z., Omura, Y., Wang, Z.-H., Zong, Q.-G. (2022)
- [2] D. Winske and W. Daughton. (2012)