

Evidence of Alfvén Waves Generated by Mode Coupling in the Magnetotail Lobe

Jicheng Sun¹

¹Polar Research Institute of China

e-mail (speaker): sunjicheng@pric.org.cn

The coupling between the magnetosphere and ionosphere is a fundamental issue in space physics, and the field-aligned current is a key process of this coupling. Alfvén waves are an important form to carry the field-aligned current and thus they play a critical role in the magnetospheric dynamics^[1]. Alfvén waves in the magnetosphere can be excited by Kelvin-Helmholtz instabilities at the magnetopause or the injected particles during substorm activities. Previous numerical simulations^[2] also suggested that some Alfvén waves can be generated by the mode coupling with the fast mode waves. However, no direct observational evidence has been found regarding to this mechanism in the magnetotail lobe. Here, we report an in-situ observation that an Alfvén wave with a period of several minutes is clearly relevant to a fast mode wave in the magnetotail lobe based on observations of the Cluster spacecraft. These waves occur at the region where the Alfvén speed has a gradient during an enhancement of the solar wind dynamic pressure. This suggests that the Alfvén wave is generated by the mode conversion at the region where

the Alfvén speed has a gradient, and the fast mode wave might be driven by the solar wind. Our observations provide an important insight into the wave generation and energy conversion in the magnetosphere.

References

[1] Keiling, A. (2009), Alfvén Waves and Their Roles in the Dynamics of the Earth's Magnetotail: A Review, *Space Science Reviews*, 142(1-4), 73-156, doi:10.1007/s11214-008-9463-8.

[2] Allan, W., and Wright, A. N. (2000), Magnetotail waveguide: Fast and Alfvén waves in the plasma sheet boundary layer and lobe, *J. Geophys. Res.*, 105(A1), 317–328, doi:10.1029/1999JA900425.

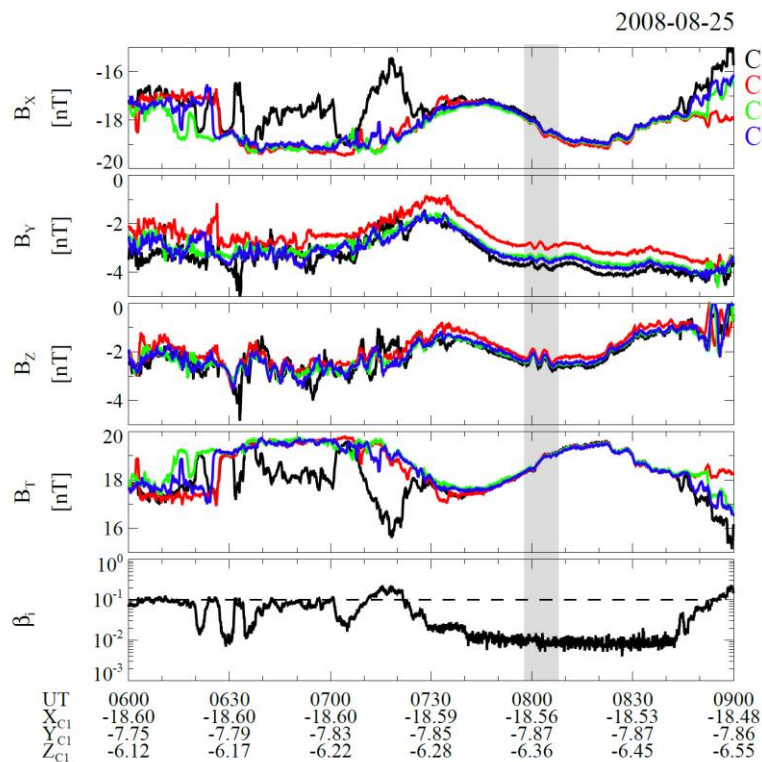


Figure 1. Three components of the magnetic field in GSM, the magnetic field strength and ion beta between 06:00 and 09:00 UT on 25 August 2008. Black, red, green and blue colors denote observations of C1, C2, C3 and C4, respectively. The shaded region indicates a wave event.