

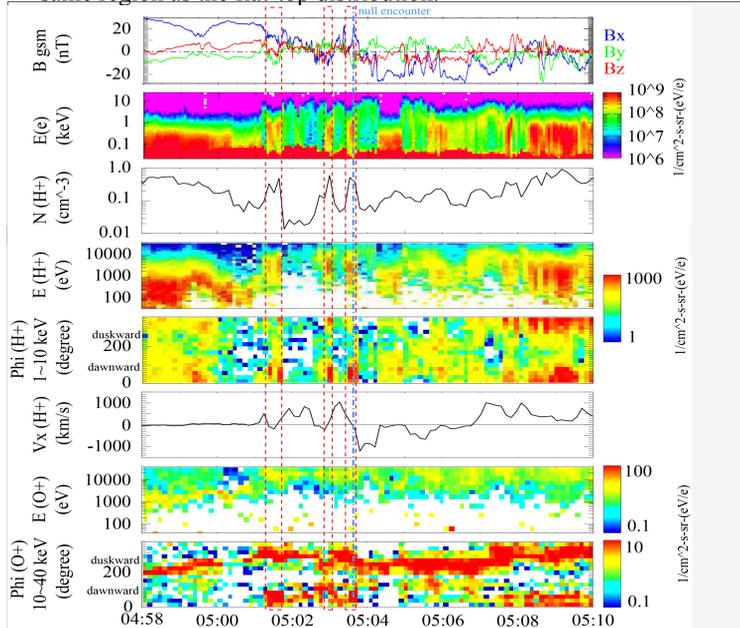
Plasma and Fields Environment in the vicinity of a 3D magnetic null

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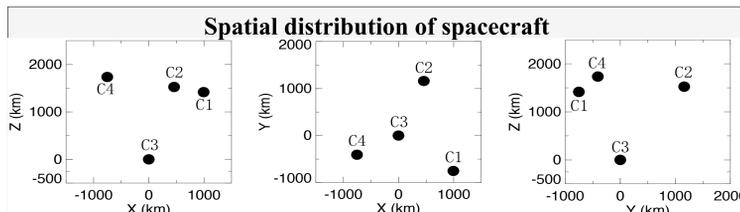
Introduction

- ❖ Xiao et al. [1] identified a 3D magnetic null inside of the tetrahedron of four spacecraft by calculating the Poincare index.
- ❖ We studied the fields and plasma environment in the vicinity of the reported 3D magnetic null, and found that the fields and plasma show unique properties. The vicinity of the null is named “null region” here after. We also found another two crossings with similar field and plasma characteristics.
- ❖ Asano et al. [3] studied the electron flat-top distribution in the outflow region. They noticed that the non-thermal electrons are not in the same region as the flat-top distribution.



Event overview

- ❖ Spacecraft cross the current sheet several times
- ❖ Electron energy increases by 10 keV
- ❖ Ion density peak
- ❖ Proton energy increases by 15 keV
- ❖ Proton flow reversal
- ❖ Oxygen energy increases by 20 keV
- ❖ dawn-dusk streaming O^+ indicating thin current sheet



- ❖ Spacecraft in the magnetotail, 19 R_E from the Earth, C1 and C2 crossed the main diffusion region, while C3 and C4 observed the bottom and top boundary regions.

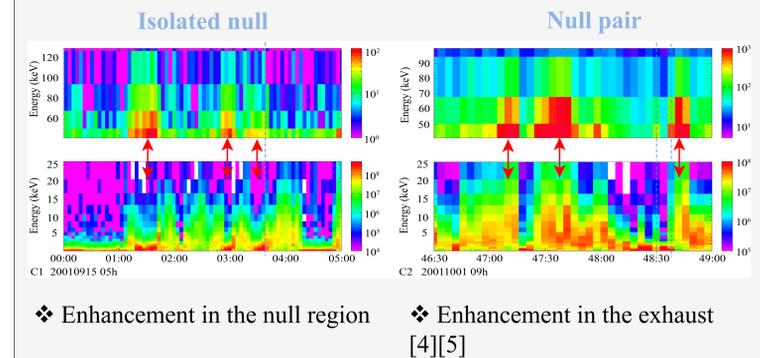
Summary

- ❖ The only reconnection event in the magnetotail which shows suprathermal electron flux enhancement not in the exhaust region. It indicates different energization mechanism or different energization efficiency for different energy level.
- ❖ For the major flow reversal at 05:03:36 UT, the magnetic field in the tailward part is consistent with spacecraft crossing the 2D exhaust from north to south. But the magnetic field at the earthward flow part is not consistent with 2D crossing.

Conclusion

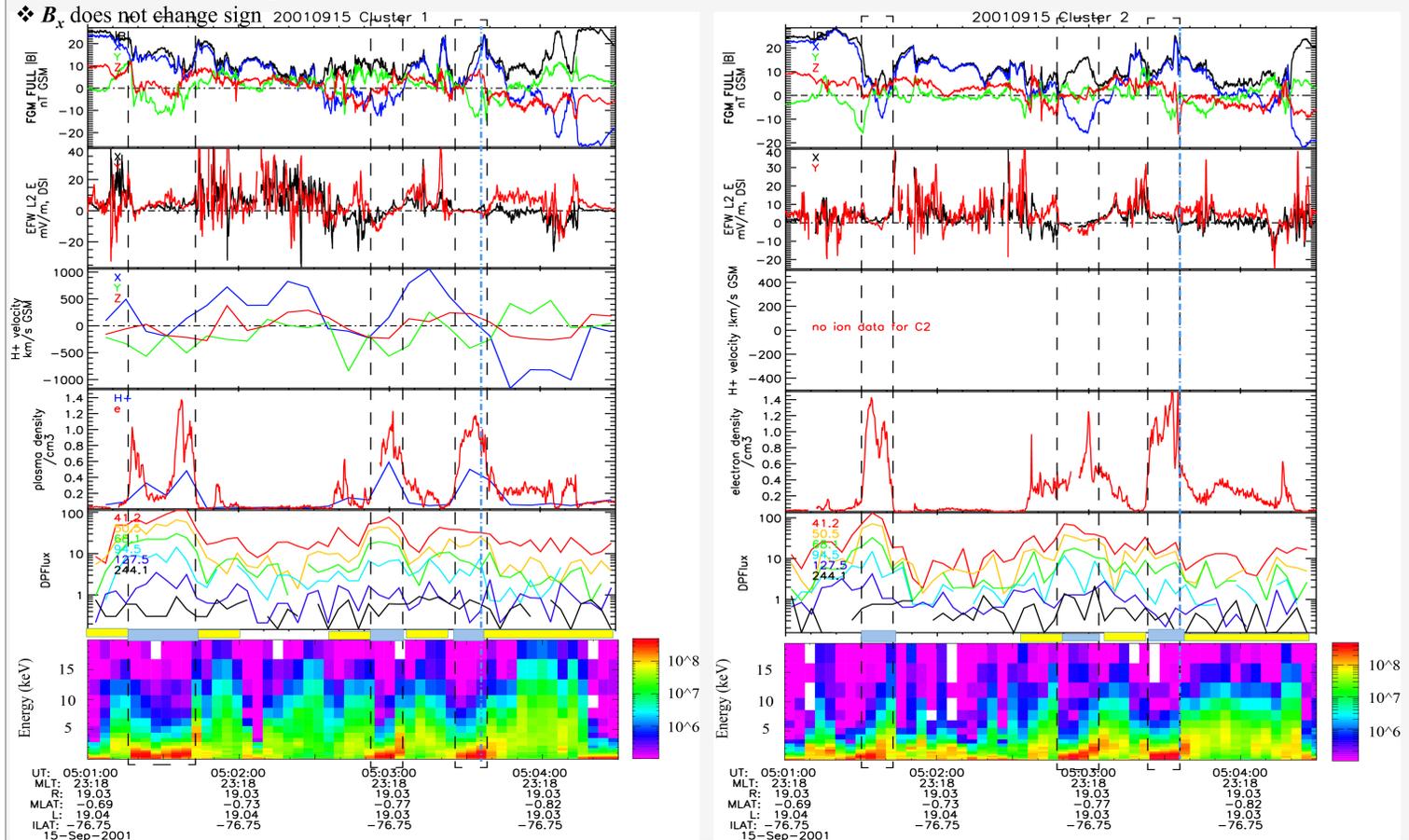
- ❖ A new structure is required since the data does not fit in 2D case
- ❖ The unique electron energy spectrum entails new electron energization mechanism
- ❖ 3D simulations with magnetic nulls will enable reconstruction of the field topology and will help to further understand particle energization.

Suprathermal electron enhancement



The fields and plasma characteristics in the null region

- ❖ Suprathermal electron flux enhancement in the null region, rather than the exhaust region
- ❖ Electric fields are quiet
- ❖ B_y and B_z usually decrease to zero or reverse sign
- ❖ Proton flow reversal
- ❖ Electron and ion density peak
- ❖ B_x does not change sign



ACKNOWLEDGEMENT

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