



ANALYSIS OF ENERGY CONVERSION PROCESSES AT KINETIC SCALES ASSOCIATED WITH A SERIES OF DIPOLARIZATION FRONTS OBSERVED BY MMS DURING A SUBSTORM



Laboratoire de Physique des Plasmas

2020 FALL SWT Online, Oct. 6th

Soboh Alqeeq (1) , Olivier Le Contel (1) , Patrick Canu (1) , Alessandro Retino (1) , Thomas Chust (1) , Laurent Mirioni (1) , Y. Khotyaintsev (2), R. Nakamura (3), F. D. Wilder (4), N. Ahmadi (4), H. Y. Wei (5), M. Argall (6), D. Fischer (3), D. J. Gershman (7), J. L. Burch (8), R. B. Torbert (6), B. L. Giles (7), S. A. Fuselier (8), R. E. Ergun (4), P.-A. Lindqvist (9), D. L. Turner (10), I. J. Cohen (11)



PAUSE
Programme national
d'Accueil en Urgence
des Scientifiques en Exil

Email address:
soboh.alqeeq@lpp.polytechnique.fr



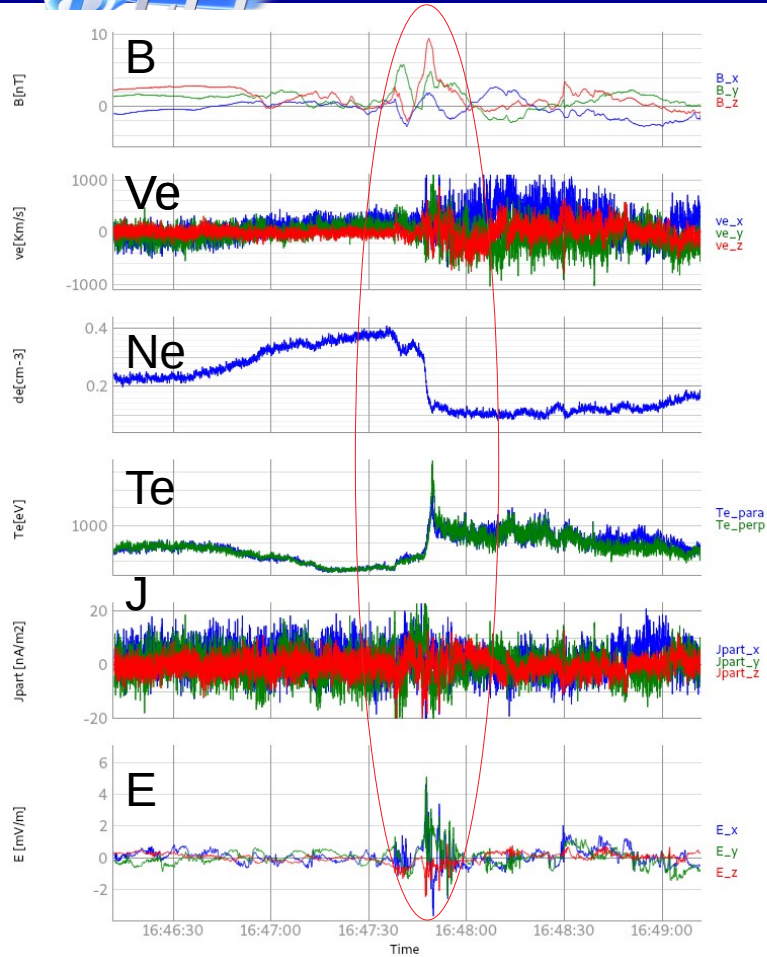
SORBONNE
UNIVERSITÉ

université
PARIS-SACLAY



One MMS DF example

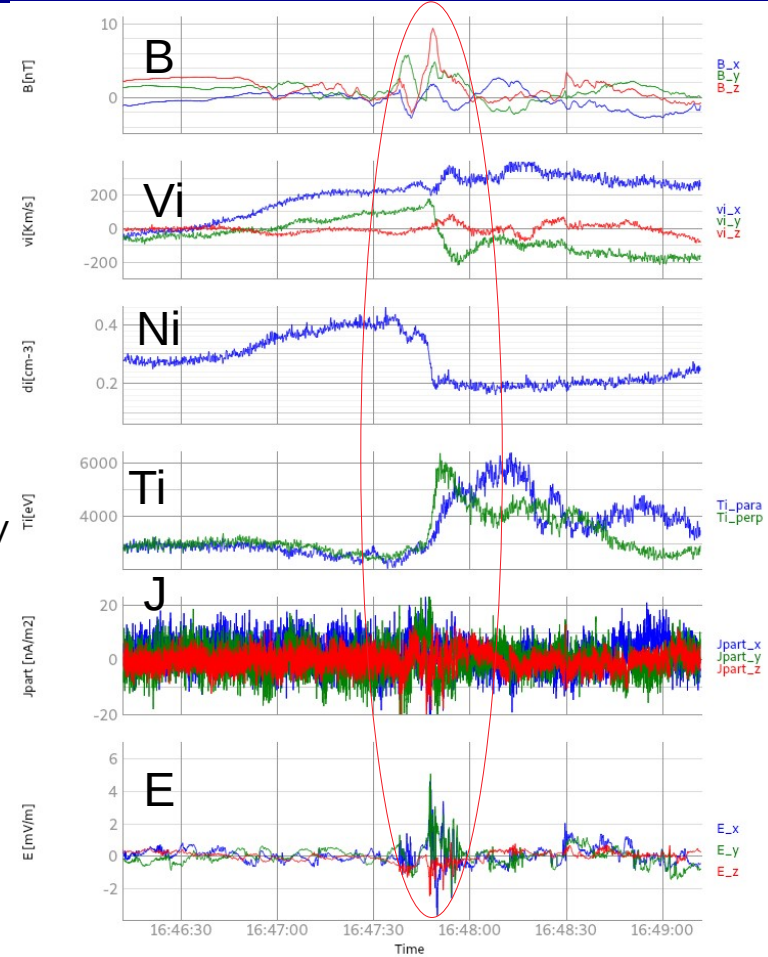
16:46:30-16:49:00 UT



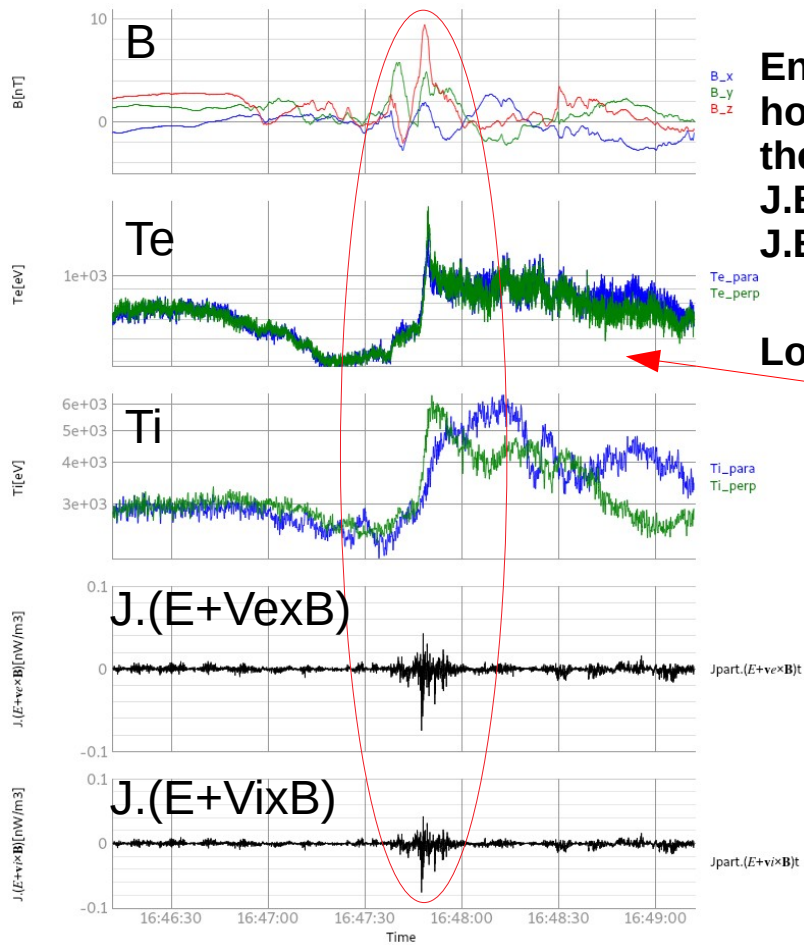
DF/fast flow properties

[e.g. Runov et al., GRL 2009, Sergeev et al., GRL, 2009]]

- Transition between cold dense plasma at rest to hot tenuous fastly moving plasma
- Increase of B_z
- Increase of Ve_x & Vi_x
- Decrease of density
- Increase of $T_{para,e} \sim T_{perp,e} \sim 1$ keV
- Increase of $T_{para,i} \sim T_{perp,i} \sim 6$ keV
- Current density $< 20 nA/m^2$
- E_y field ~ 4 mV/m



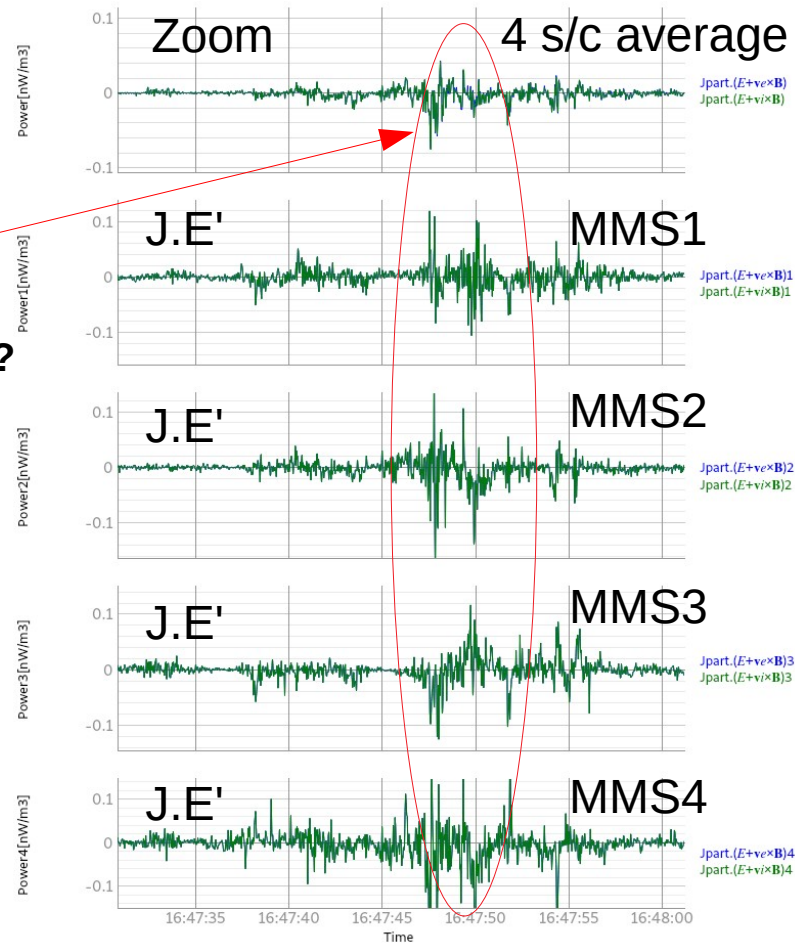
Energy conversion 16:46:00-16:49:00 UT



Energy conversion is not homogeneous at the scale of the tetrahedron :
 $J \cdot E' > 0$ & < 0 depending on s/c
 $J \cdot E' < 0$ for 4 s/c average

Local electron & ion heating ?

Max Te ~ 2000eV
 Max Ti ~ 6000eV



Summary



- › We have shown a DF event detected by MMS during a subsorm event on July 23rd 2017 with classical signatures consistent with general properties of DF.
- › We have found a good agreement between current densities calculated from particles and curl B (not shown).
- › From Ohm's law, electrons are found almost always magnetized whereas ions can be decoupled from B due to Hall field (not shown).
- › Energy conversion given by $(\mathbf{J} \cdot (\mathbf{E} + \mathbf{v} \times \mathbf{B}))$ or $(\mathbf{J} \cdot (\mathbf{E} + \mathbf{v} \times \mathbf{B}))$ is not homogeneous at the scale of the tetrahedron :
4 s/c average value indicates an energy transfer ($\mathbf{J} \cdot \mathbf{E}' < 0$) from particles to fields at the beginning of the DF crossing whereas individual s/c values can be positive or negative which require further investigations.

Acknowledgments: We thank the whole MMS team for providing data and the spedas software team in particular E. Grimes for pypedas effort developments.

