

Kinetic Plasma Turbulence in the Fast Solar Wind Measured by Cluster

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Introduction

- The turbulence in the fast Solar wind is investigated using multipoint magnetometer data from Cluster's FGM instrument and two methods
 - 1 K-filtering (Pinçon an Lefeuvre 1991)
 - 2 Polarization analysis (He et al 2012) in two planes
- There have been conflicting results from the application of the k-filtering method to the Solar wind
- Linear waves vs Coherent structures



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Data sets

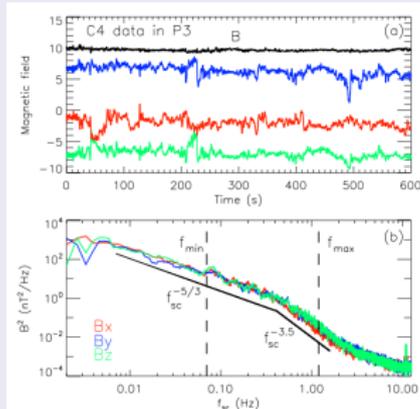
Parameters

TABLE 1

AVERAGE PLASMA PARAMETERS DURING THE TIME PERIODS THAT K-FILTERING TECHNIQUE IS APPLIED (DATA ARE FROM CIS, FGM AND PEACE).

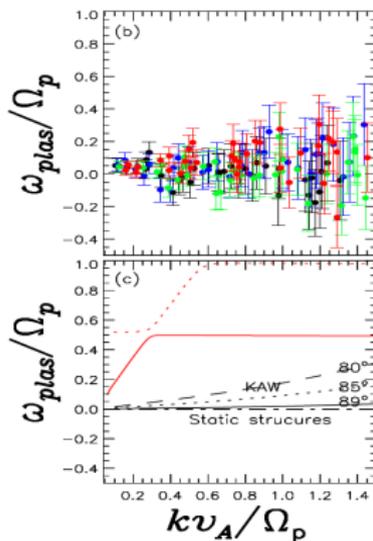
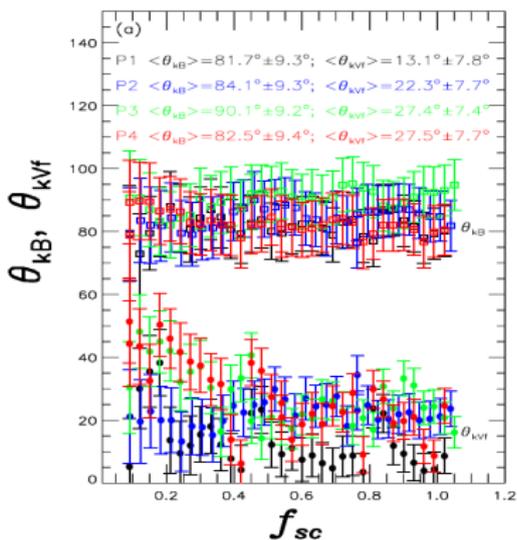
	Jan. 31 (P1) 14:30-14:40	Jan. 31 (P2) 14:45-14:55	Feb. 29 (P3) 04:10-04:20	Feb. 29 (P4) 04:25-04:35
B (nT)	8.45	7.97	9.56	9.34
$n(\text{cm}^{-3})$	3.47	3.25	2.88	2.73
β	0.62	0.72	0.73	0.67
V_f	613	609	646	657
f_{ci}	0.129	0.122	0.146	0.142
v_A	99.1	96.2	123.1	123.4
E	0.05	0.04	0.01	0.02
P	0.07	0.06	0.03	0.01
θ_{VB}	75.1°	66.6°	78.6°	84.1°
$T_{i\perp}/T_{i\parallel}$	1.41	1.28	1.26	1.46
T_e/T_i	N/A	N/A	0.37	0.39
ρ_i (km)	122	126	134	138
n_{α}/n_p	1.4%	1.3%	0.38%	0.2%

Magnetic Field

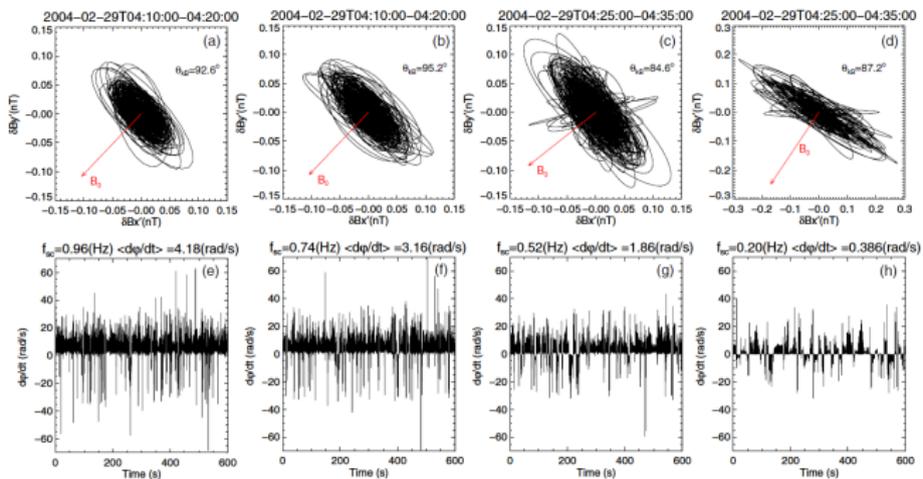


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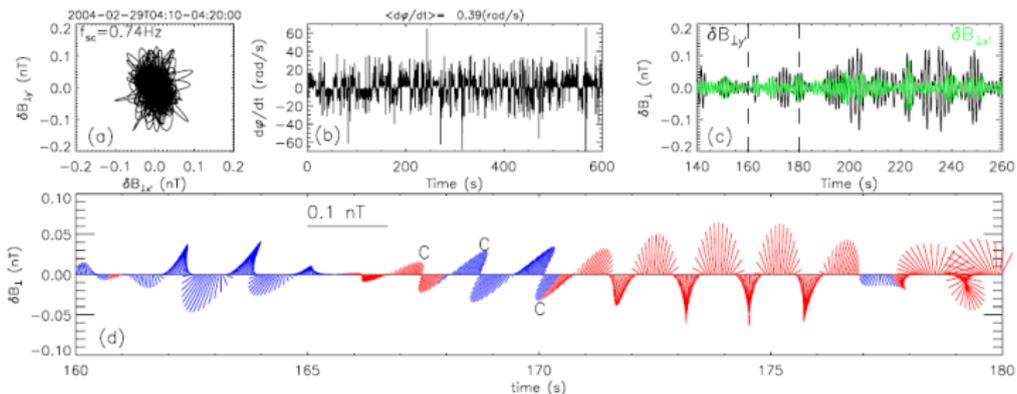
K-filtering results



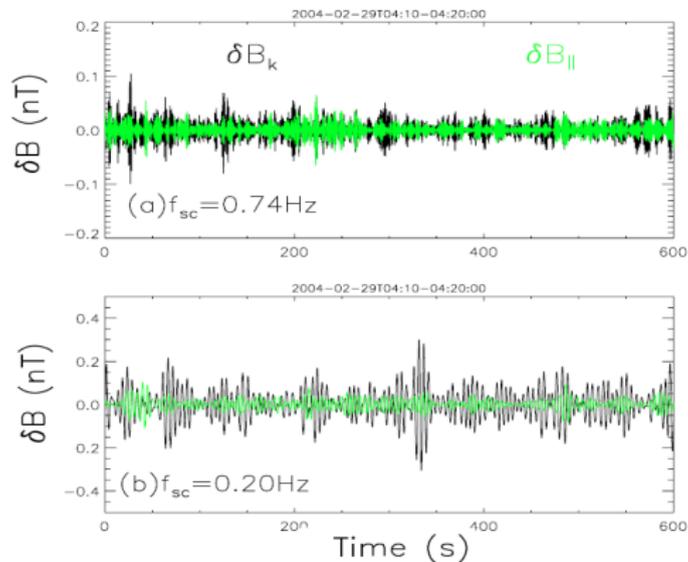
Polarization in the plane perpendicular to \mathbf{k}



Polarization in the plane perpendicular to \mathbf{B}_0



Fluctuations along \mathbf{k} and \mathbf{B}_0



Conclusions

- The turbulence is found to be highly anisotropic $\mathbf{k}_\perp \gg \mathbf{k}_\parallel$
- Dispersion relation is more consistent with a superposition of KAWs
- Polarization in the plane perpendicular to \mathbf{k} supports KAW interpretation (within error limit!!)
- Polarization in plane perpendicular to \mathbf{B}_0 supports Coherent Structures
- Compressible theories of structures such as Alfvén vortices are required
- Coexistence of Linear waves and structures?

