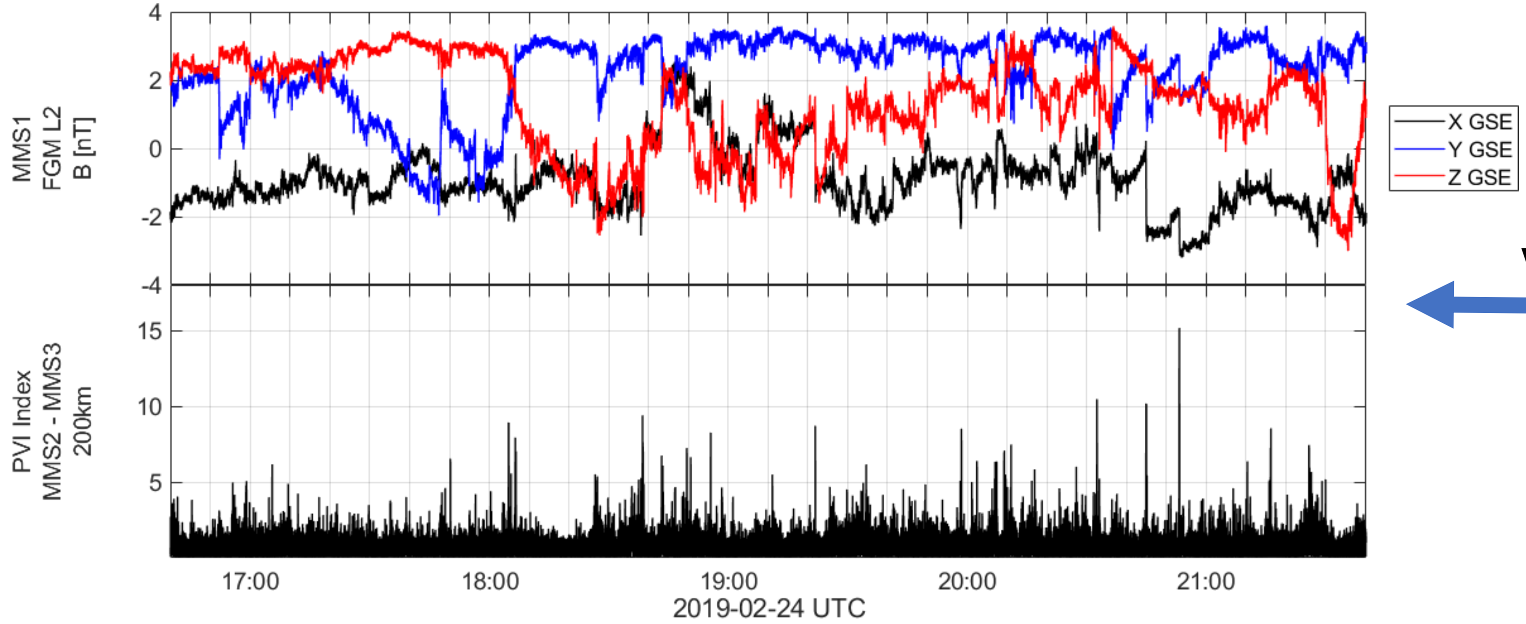
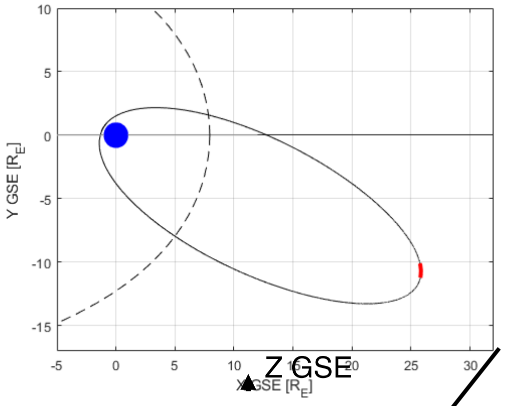
MMS solar wind turbulence campaign

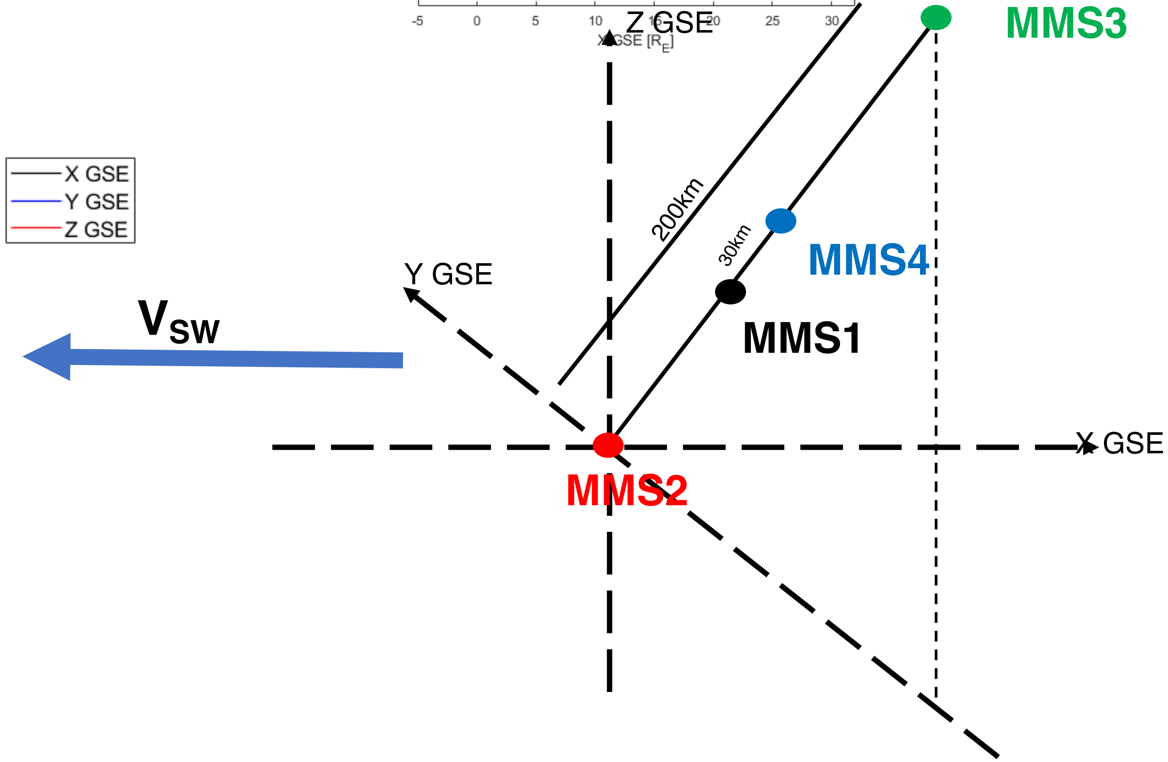
One year ago in Santa Fe, we showed the first results from the MMS solar wind turbulence campaign…

Solar wind turbulence campaign

- 5 hours long burst
- Spacecraft in co-linear separation





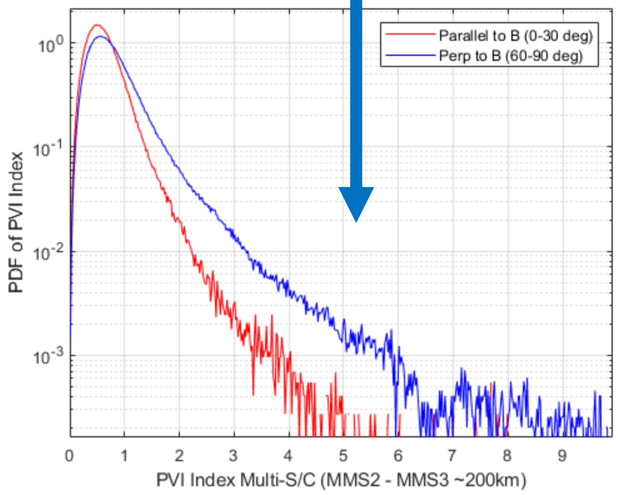


Results: Intermittency

- Direct measurement of intermittency parallel and perpendicular to B
- Increase observed perpendicular to magnetic field
- Non-Gaussian fluctuations peak at 65°

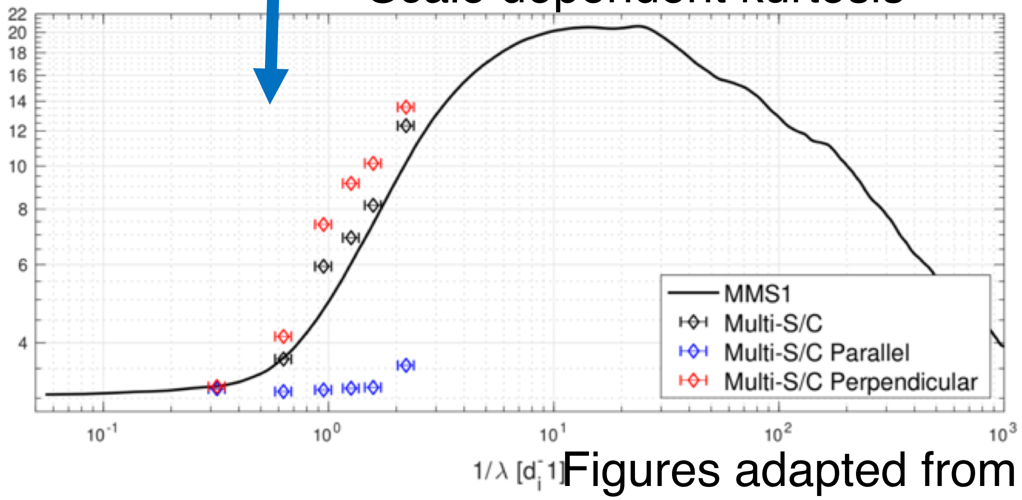
Maximum observed at ~ 65°

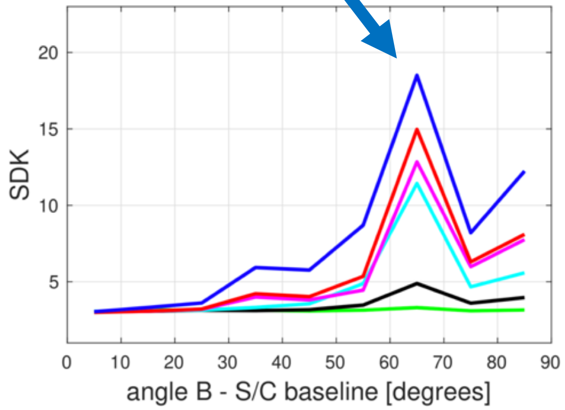
Current sheets predominantly perpendicular to B



Increased intermittency perpendicular to B

Scale dependent kurtosis

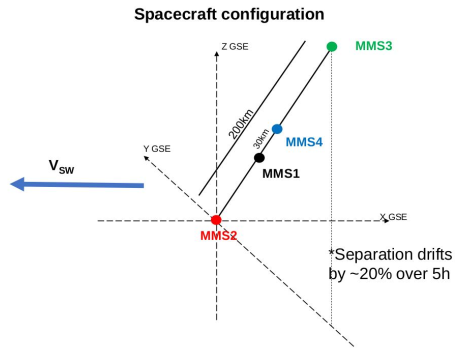




Figures adapted from Chasapis et al. ApJ, In press

Results: Taylor Microscale

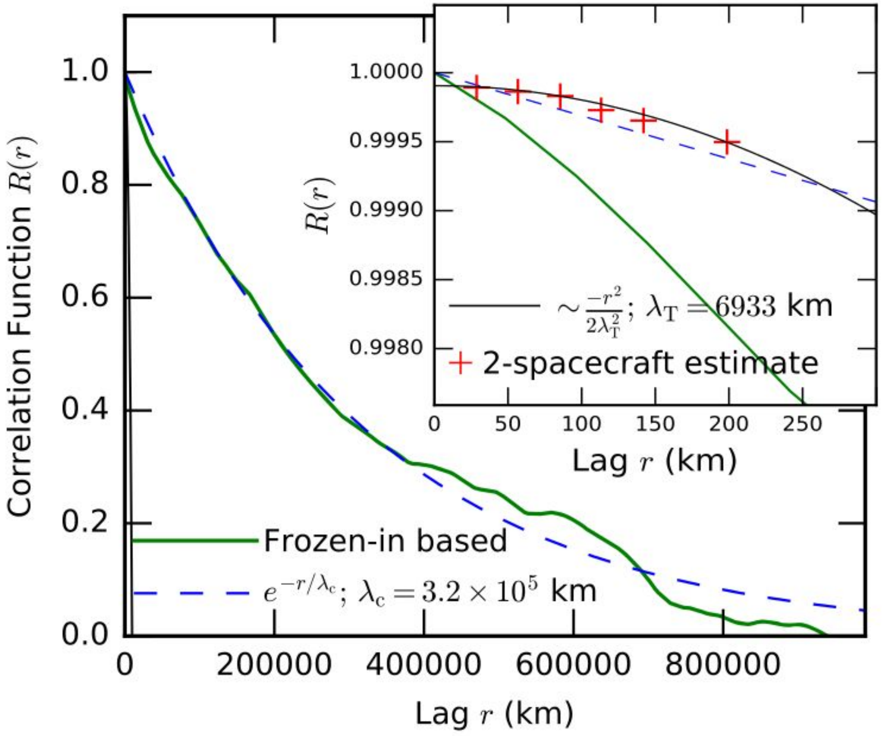
MMS Turbulence Campaign: Direct Evaluation of Taylor-microscale in the Solar Wind



$$\frac{1}{\lambda_T} = \sqrt{\frac{\left\langle \left(\frac{\partial F}{\partial x}\right)^2 \right\rangle}{\langle F^2 \rangle}} \rightarrow \frac{1}{V_{sw}\tau_{TS}} = \frac{1}{V_{sw}}\sqrt{\frac{\left\langle \left(\frac{\partial F}{\partial t}\right)^2 \right\rangle}{\langle F^2 \rangle}}$$

$$R(\tau) \approx 1 - \frac{\tau^2}{2\tau_{TS}^2} + \ldots.$$

- Taylor-microscale is important in turbulence
- Measurement is hard due to low time-cadence data
- Several studies have attempted to measure λ_T (Matthaeus+, 2005; Weygand+, 2007, 2009, 2010,2011; Gurgiolo+, 2013, Chuychai+, 2014)
- Using a single 5-hour interval, we show the difference of 2-s/c and 1-s/c estimate
- We estimate λ_T~ 7000 km
- May vary due to solar wind condition



Bandyopadhyay et al., 2020, ApJ (https://doi.org/10.3847/1538-4357/ab9ebe)

Solar Wind Turbulence Campaign

Laboratory for Atmospheric and Space Physics
University of Colorado **Boulder**

The MMS solar wind turbulence campaign led to new approaches in studying solar wind turbulence:

- Direct measurements of intermittency at kinetic scales (Chasapis et al. 2020)
- 2-point evaluation of the Taylor microscale (Bandhyopadhyay et al. 2020)

Future work using the co-linear multi-point measurements in solar wind turbulence…