ÖAW — AUSTRIAN ACADEMY OF SCIENCES

SOLAR WIND ION MEASUREMENTS FROM THE MMS FPI

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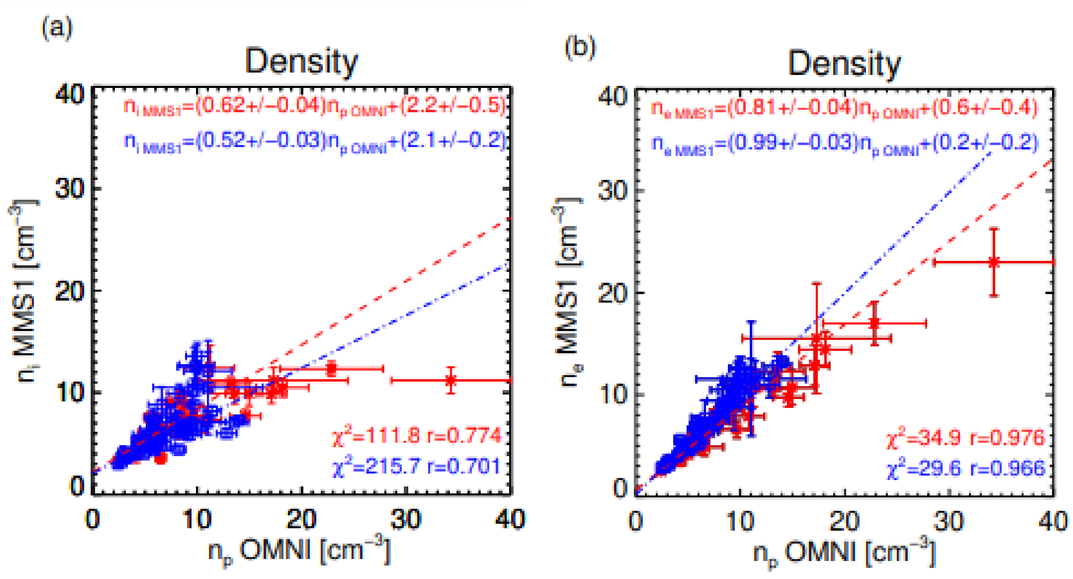
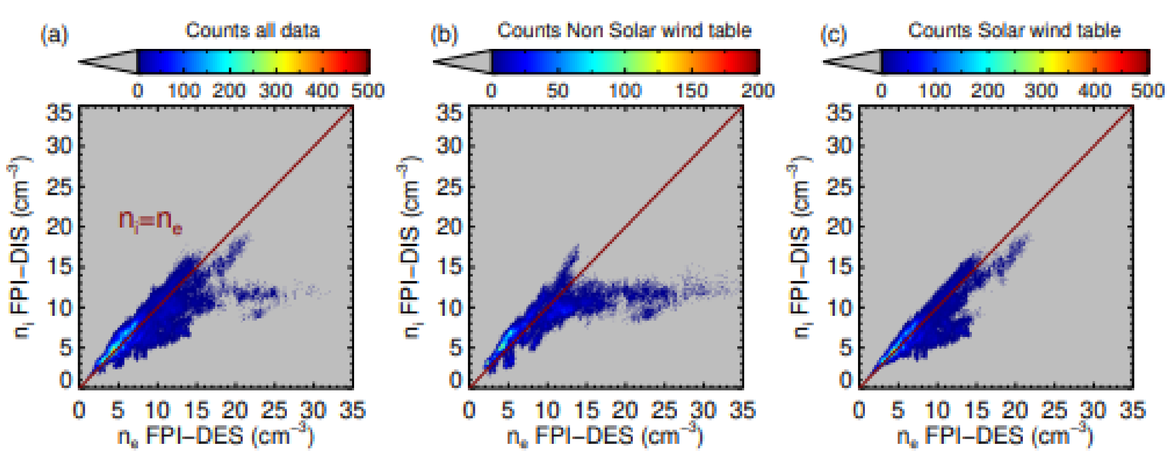
MMS' Fast Plasma Investigation is an instrument designed with the goal of performing measurements of magnetospheric plasma with high time resolutions. Recently the orbit of MMS has allowed measurements of solar wind plasma which is characterized by a much narrower beam when compared to the angular resolution of FPI. To better understand the limitations of the ion measurements in the solar wind we compare the mean values obtained from MMS with the values obtained from OMNI for the same time period. The burst mode data are subject to some spin effects. An empirical model of the spin variation is obtained from the data, and removed to correct the data.

- A comparison of the OMNI proton density and the MMS ion (a) and electron densities (b) are presented below. The red points show data taken when the solar wind energy azimuth table is not in use and the blue points denote when it is in use. The error bars denote the standard deviations of the time series.

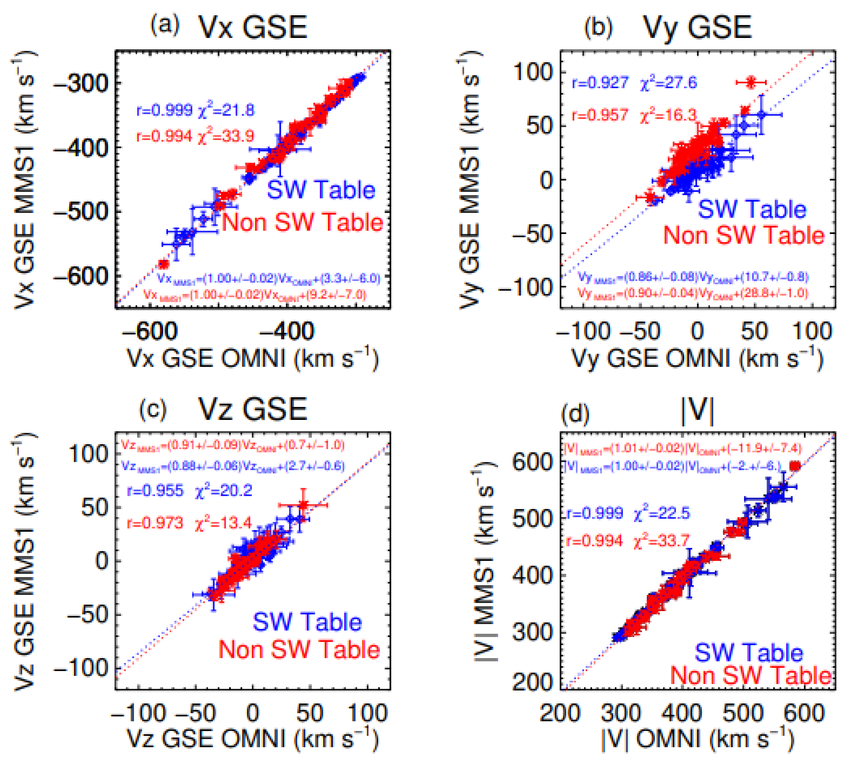


- A comparison of the MMS ion density and the MMS electron density are shown below, which uses all the data (a) only the non solar wind table (b) and using the solar wind table (c).



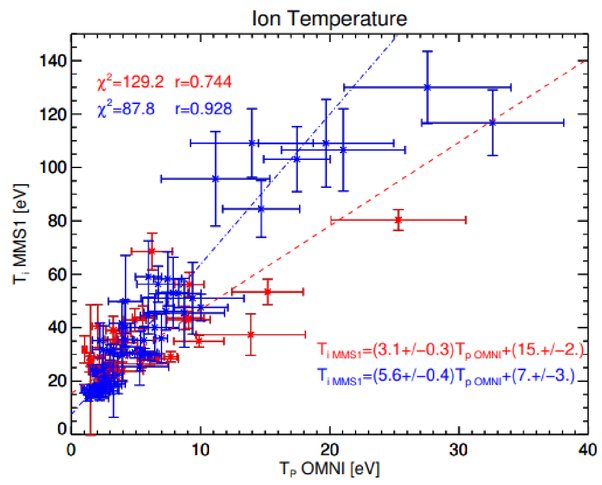
FAST SURVEY MODE VELOCITY

- A comparison of the OMNI proton velocity and the MMS ion velocity is shown below. The velocity is well estimated from FPI. For the y component of the velocity there is an offset depending on the energy=azimuth table used.



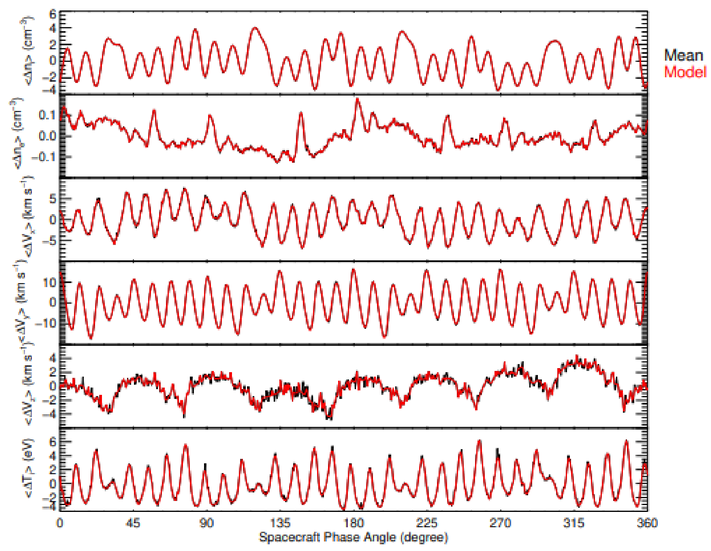
FAST SURVEY MODE TEMPERATURE

- A comparison of the MS ion temperature is shown below It can be seen that the temperature is overestimated by MMS.

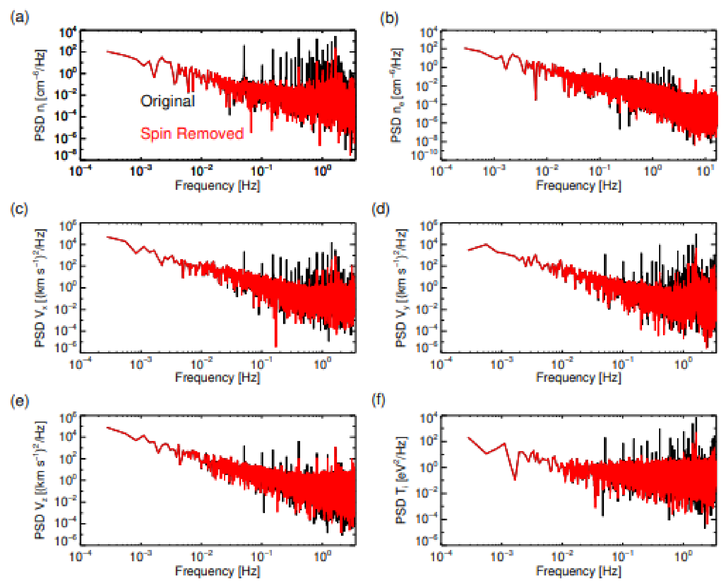


BURST SURVEY MODE SPIN EFFECTS

- The narrow beam relative of the plasma in the solar wind with respect to the angular resolution causes angular structure to appear in the data. This is most prominent in the density. To correct for this we bin the data by spacecraft phase angle and fit a model to the fluctuations/ These can then be subtracted removing the spin effect.



- The Fourier power spectral densities of the measured data are shown below in black, the spin removed data are shown in red. Spikes in the Fourier are removed effectively.



SUMMARY

- We compare mms fpi measurements in the solar wind to omni
- The ion density is understimated due to overcounting in fast survey mode or saturation in burst mode. The electron density agrees well with the omni proton density
- The ion velocity is well estimated. An offset in the vy component is removed by using the solar wind energy-azimuth table
- The ion temperature is overestimated.
- To calculate parameters such as plasma beta it is better to use the electron density and the ion density from omni
- We are able to correct for the spin by developing an empirical model of the variation of the detector with spin phase.

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