First Results on Production of Magnetosheath Jets during SIRs and CMEs

F. Koller[1], L. Preisser[2], M. Temmer[1], and F. Plaschke[2,3]

[1] Institute of Physics, University of Graz, Graz, Austria [2] Space Research Institute, Austrian Academy of Sciences, Graz, Austria [3] Technical University Braunschweig, Braunschweig, Germany

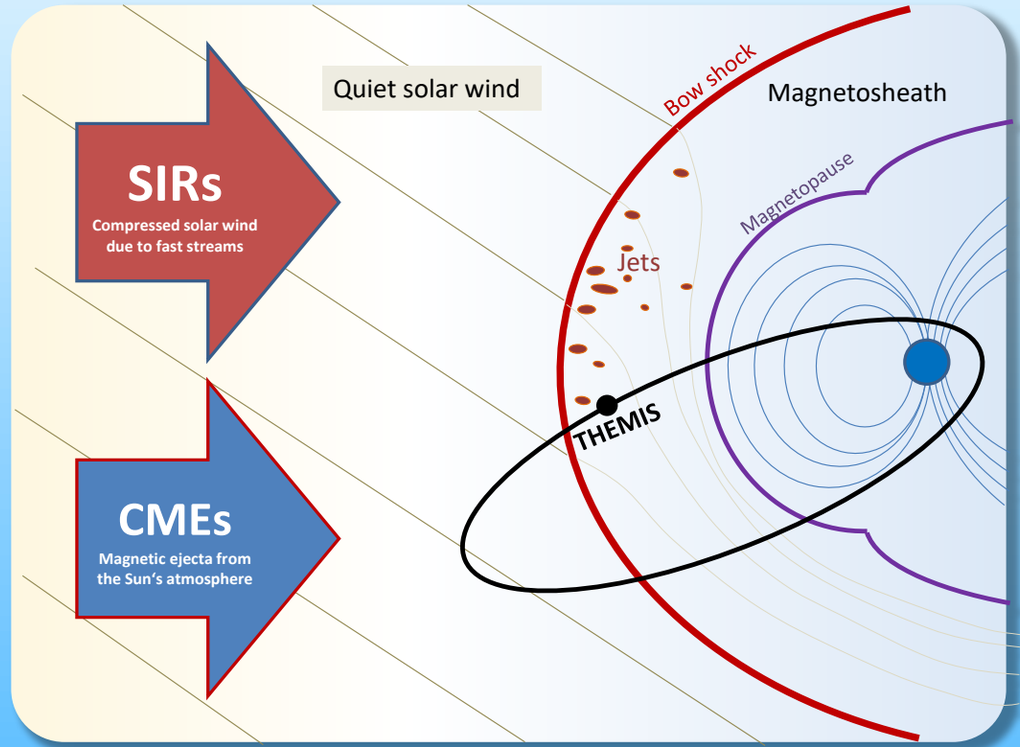
Magnetosheath jets: Basics, Motivation, Methods

- **Dynamic pressure enhancements** in the Earth's Magnetosheath, usually downstream of the quasi-parallel shockfront (Plaschke et al. 2018)
- Can impact Magnetopause and be geoeffective (Hietala et al. 2018, Wang et al. 2018, Nykyri et al. 2019)
- Get generated at the bow shock by rippling in the foreshock (Plaschke et al. 2018)
- Magnetosheath jets constitute a key linking effect between the solar wind – magnetosphere interaction and are very frequent (Plaschke et al. 2018)
- So far unknown: Effects of large scale SW structures on jets; effects of the solar cycle on the properties and amount of jets, details of jet origins still part of active research
- They should appear at all bow shocks with high Alfven Mach numbers – future prospect of analysis on different magnetospheres

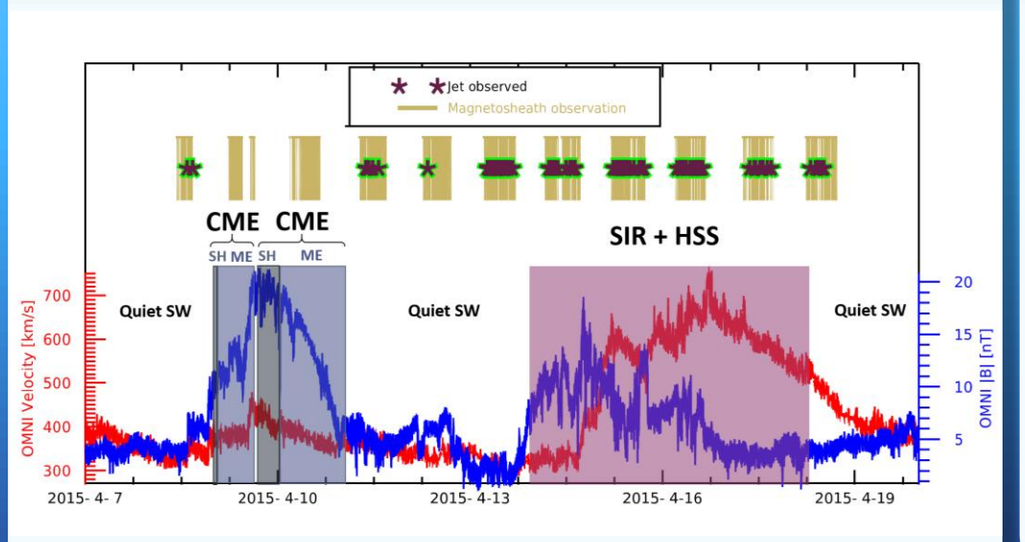
Research question: how does the appearance of large-scale disturbances in the solar wind (CMEs, SIRs, HSS) influence the generation of magnetosheath jets?

- **Jet Data:** Jets detected by THEMIS from 2008-2020 using two different criteria (one based on upstream SW conditions (Plaschke et al. 2013), one on local magnetosheath conditions)
- **CME data**: list by Richardson & Cane (2010) for CME-magnetic ejecta and CME-sheaths
- **SIR and HSS data**: Combined list of Grandin et al. (2019), Jian et al. (2011), Geyer et al. (2021), and self expanded

- **Basic Method**: analyse overlapping times of magnetosheath measurements and jets with times of CME and SIR passings
- We define a „jet percentage": total time of jets divided by total time of magnetosheath data within a given time range
- We used superposed epoch analysis to get an idea about the jet percentage development within CMEs and SIRs



Vizualisation of timeline with overlapping events



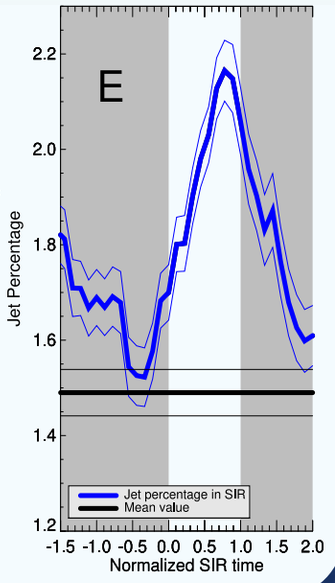
Results: Jets during SIRs and HSS

Significant **INCREASE** of jet numbers during SIRs and HSS

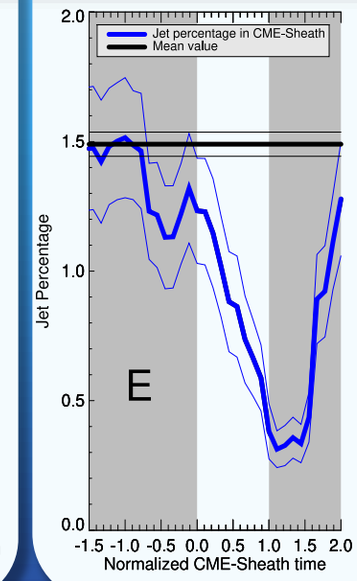
Roughly coincides with the velocity increase of the solar wind

The percentage slowly drops down to usual levels after the pasing of the high speed stream

Confirmed expected results



Results: Jets during CMEs

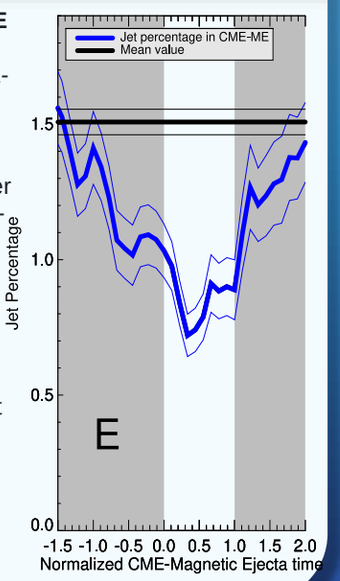


Signifcant **DECREASE** in jet numbers during CME-sheath and CME-magentic ejecta

Clear, monotonic decrease in the number of jets within the CME-sheath

The jet percentage reaches ist minimum within the magnetic ejecta and recovers quickly after the event

Seemingly anti-correlated with magnetic field



References

Geyer, P., Temmer, M., Guo, J., & Heinemann, S. G.(2021, May). A&A, 649, A80. doi: 10.1051/0004-6361/202040162
Grandin, M., Aikio, A. T., & Kozlovsky, A. (2019, June). Journal of Geophysical Research (Space Physics), 124(6), 3871-3892. doi: 10.1029/2018JA026396
Hietala, H., Phan, T. D., Angelopoulos, V., Oieroset, M., Archer, M. O., Karlsson, T., & Plaschke, F. (2018, February). Geophysical Research Letters, 45(4), 1732-1740.doi: 10.1002/2017GL076525
Jian, L. K., Russell, C. T., & Luhmann, J. G. (2011, December). SoPh,274(1-2), 321-344. doi: 10.1007/s11207-011-9737-2
LaMoury, A. T., Hietala, H., Plaschke, F., Vuorinen, L., & Eastwood, J. P.(2021). Submitted to JGR
Nykyri, K., Bengtson, M., Angelopoulos, V., Nishimura, Y., & Wing, S.(2019, June). Journal of Geophysical Research (Space Physics),124(6), 4-4340. doi:43210.1029/2018JA026357
Plaschke, F., Hietala, H., & Angelopoulos, V. (2013, October). Annales Geophysicae,31(10), 1877-1889. doi: 10.5194/angeo-31-1877-2013
Plaschke, F., Hietala, H., Archer, M., Blanco-Cano, X., Kajdi˘c, et al. (2018, August). SSR, 214(5), 81. doi: 10.1007/s11214-018-0516-3
Richardson, I. G., & Cane, H. V. (2010, June). SoPh,264(1), 189-237. doi: 10.1007/s11207-010-9568-6
Wang, B., Nishimura, Y., Hietala, H., et al. (2018, June). Journal of Geophysical Research (Space Physics),123(6),4879-4894. doi: 10.1029/2017JA02495