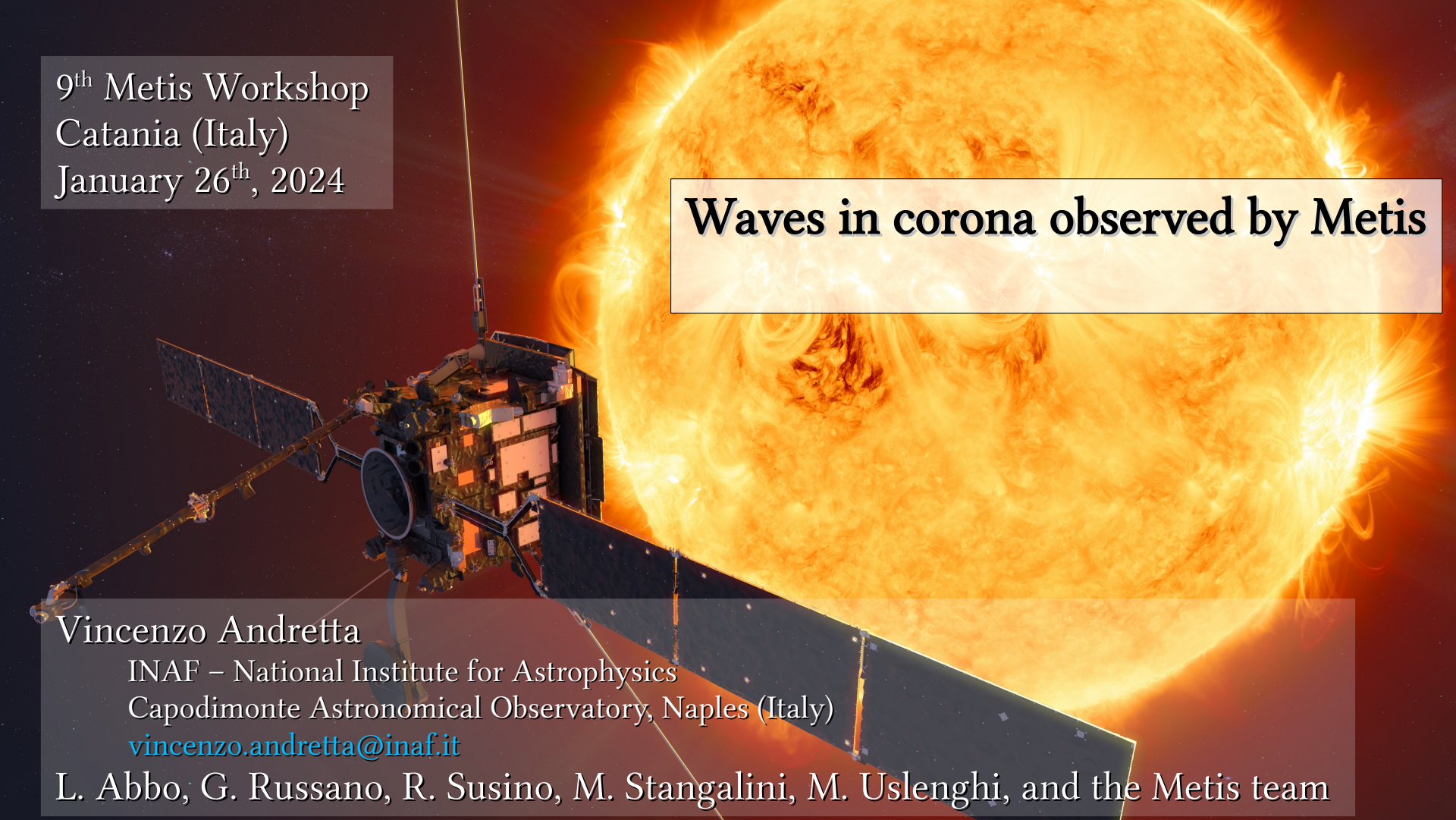


9th Metis Workshop
Catania (Italy)
January 26th, 2024

Waves in corona observed by Metis

Vincenzo Andretta
INAF – National Institute for Astrophysics
Capodimonte Astronomical Observatory, Naples (Italy)
vincenzo.andretta@inaf.it
L. Abbo, G. Russano, R. Susino, M. Stangalini, M. Uslenghi, and the Metis team

Metis capabilities of high-cadence measurements

Metis acquisition Schemes

VL channel	VL-pB	Polarised brightness acquisition
	VL-tB	Total brightness acquisition
	VL-FP	Fixed polarisation acquisition
	VL-TN	Temporal noise acquisition
UV channel	UV-Analogue	Analogue mode acquisition
	UV-PC	Photon counting acquisition [(a)]
	UV-PC-Offset	Photon counting offset mode
	UV-TN	Temporal noise acquisition

(DIT > 15 s x 4 polarisations) > 60 s

DIT > 20 s

DIT > 1 s

Antonucci et al. A10 (2020)

Metis capabilities of high-cadence measurements

Metis acquisition Schemes

VL channel	VL-pB	Polarised brightness acquisition
	VL-tB	Total brightness acquisition
	VL-FP	Fixed polarisation acquisition
	VL-TN	Temporal noise acquisition
UV channel	UV-Analogue	Analogue mode acquisition
	UV-PC	Photon counting acquisition [a]
	UV-PC-Offset	Photon counting offset mode
	UV-TN	Temporal noise acquisition

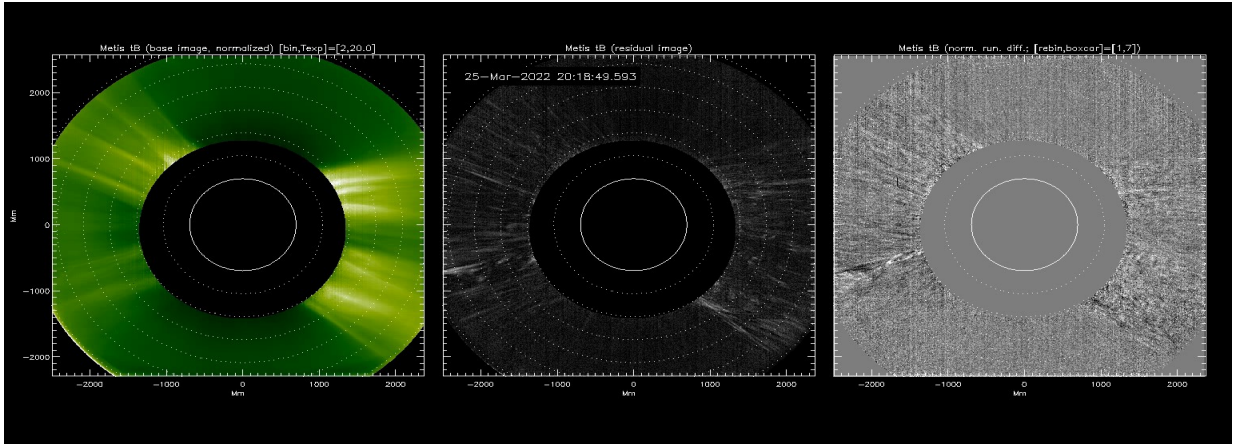
(DIT > 15 s x 4 polarisations) > 60 s

DIT > 20 s

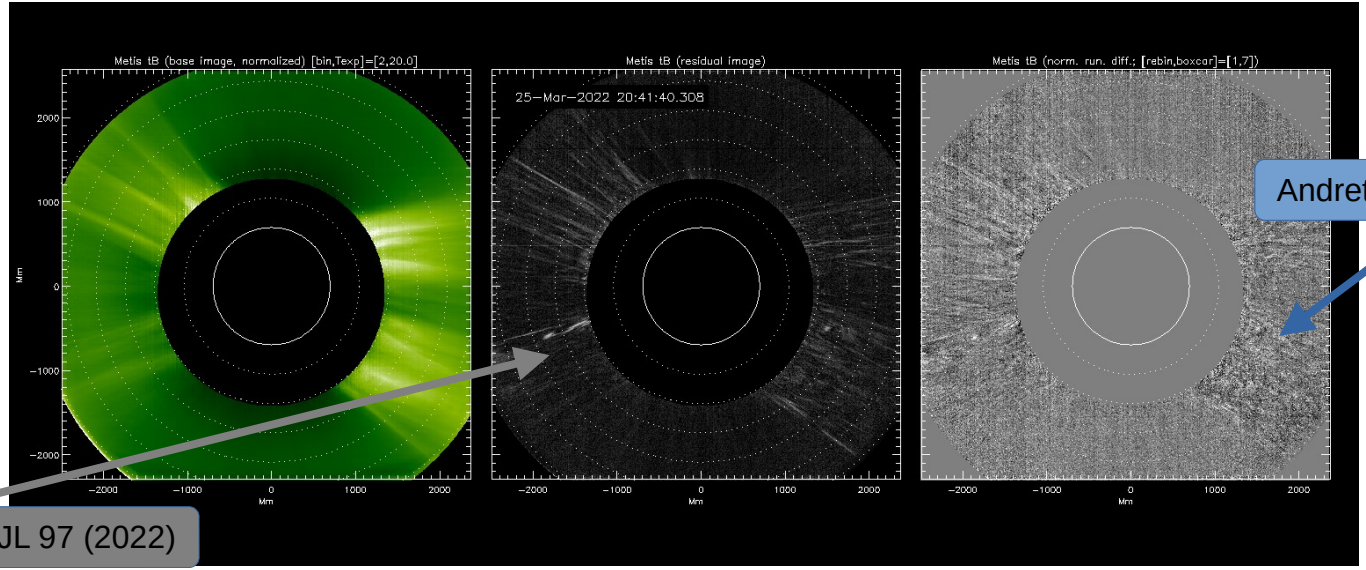
DIT > 1 s

Antonucci et al. A10 (2020)

An example during the 1st perihelion of the nominal mission



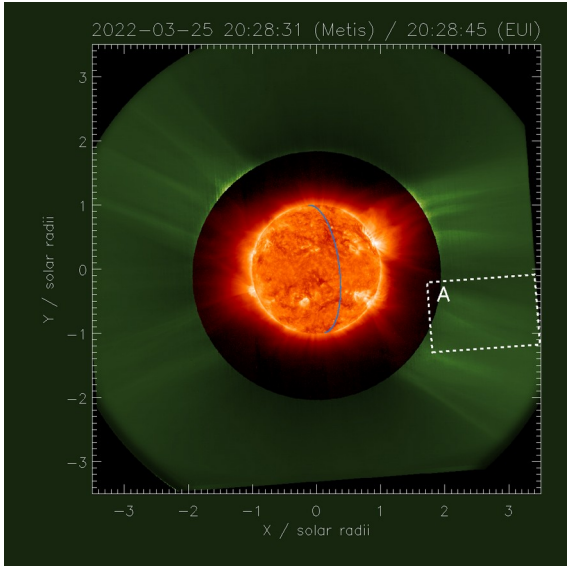
An example during the 1st perihelion of the nominal mission

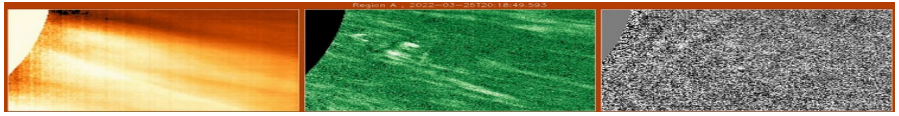


Andretta et al., in prep.

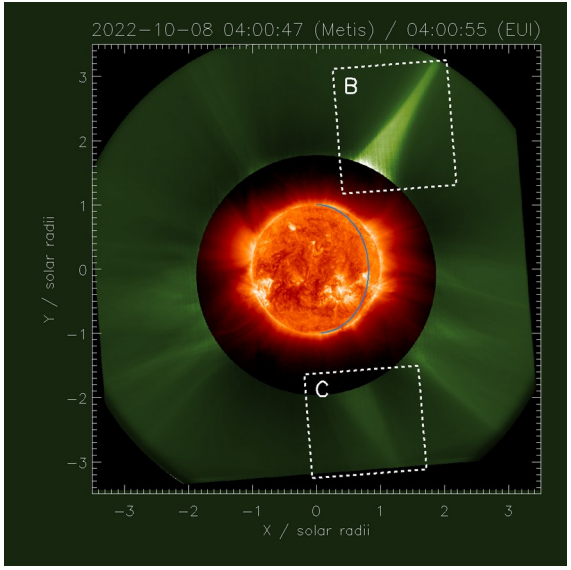
Telloni et al., ApJL 97 (2022)

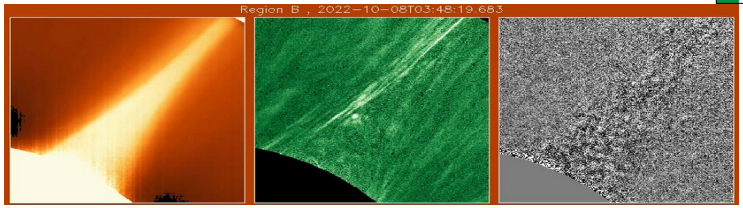
A closer look

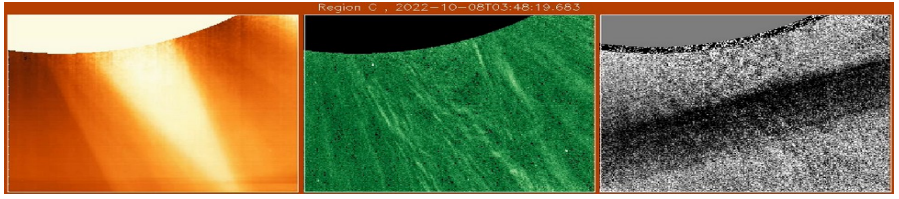




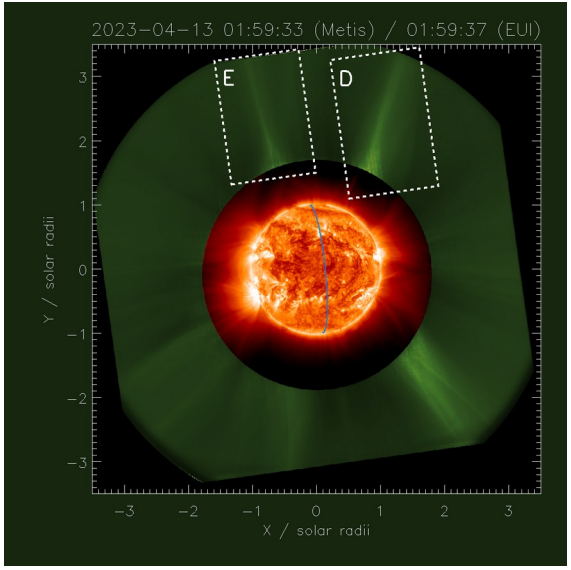
Examples from selected regions of interest: 2nd perihelion

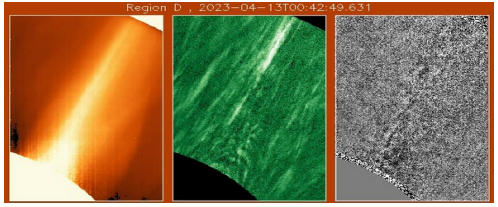


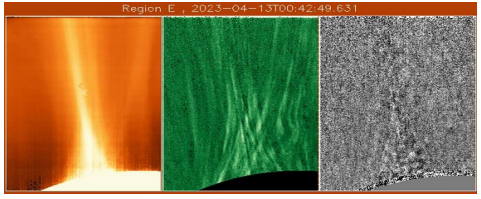




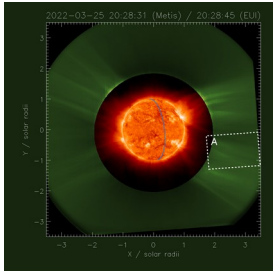
Examples from selected regions of interest: 3rd perihelion

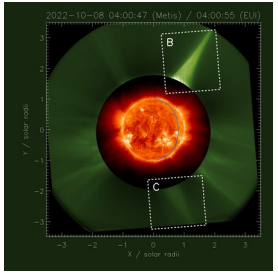


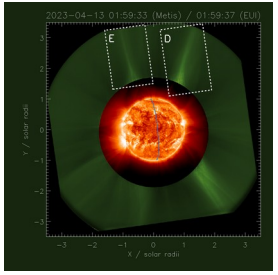


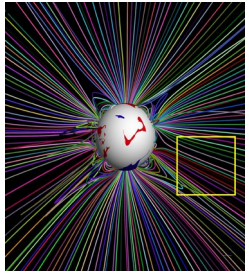


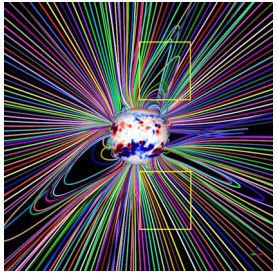
On the magnetic configurations in the regions of interest

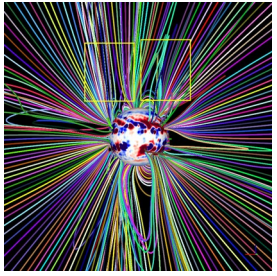






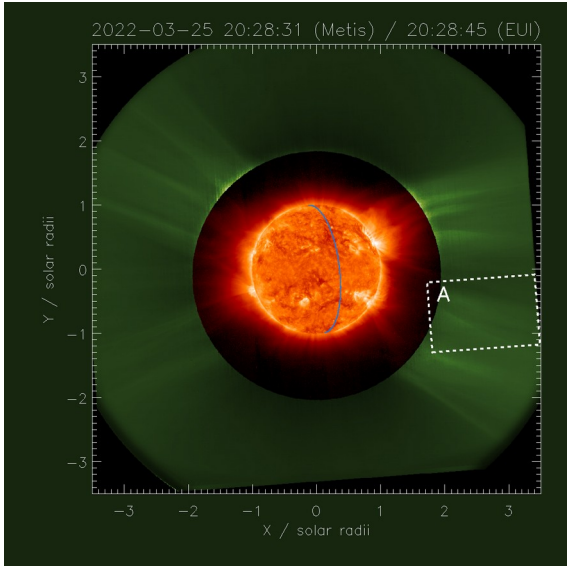


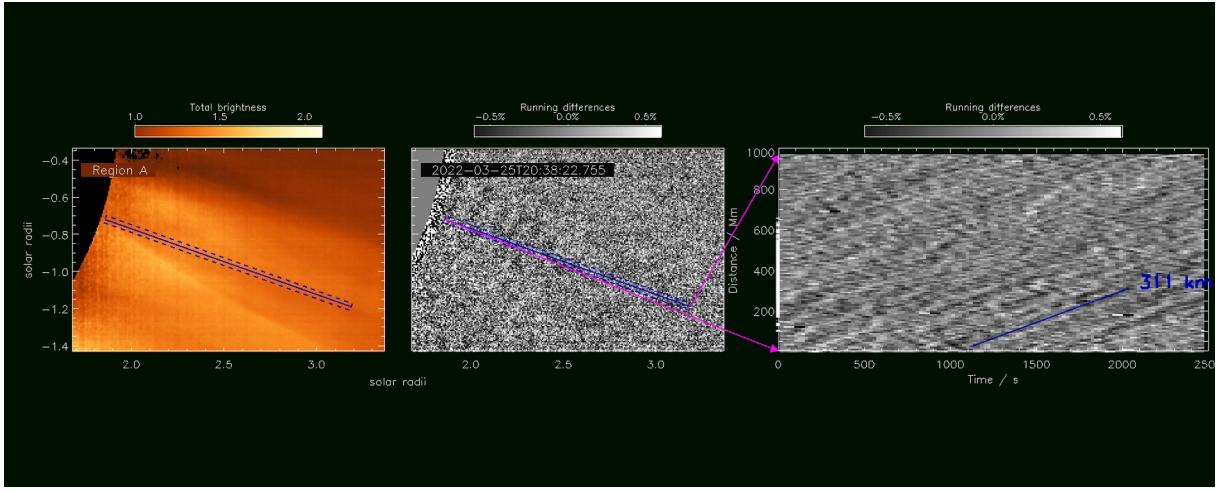




Time-distance diagrams: 1st perihelion

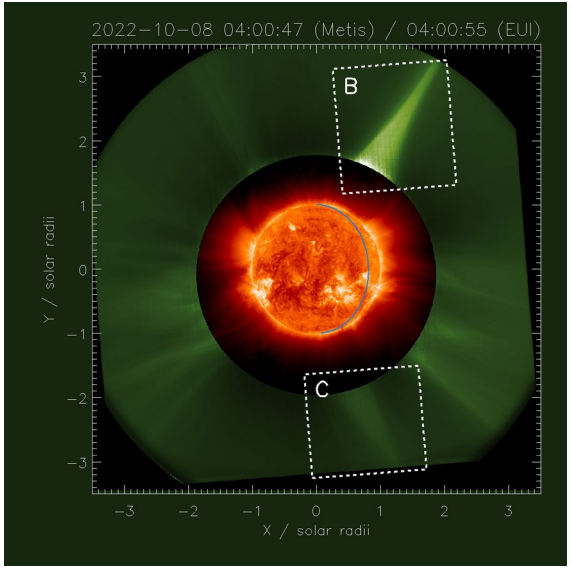
25-03-2022 (duration: 41 min)

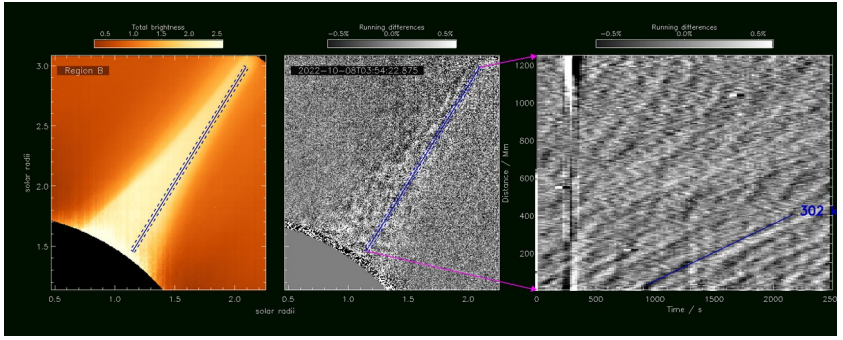


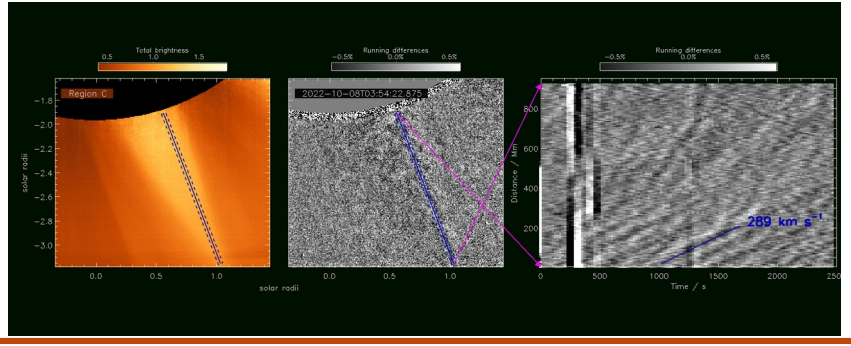


Time-distance diagrams: 2nd perihelion

08-10-2022 (duration: 41 min)

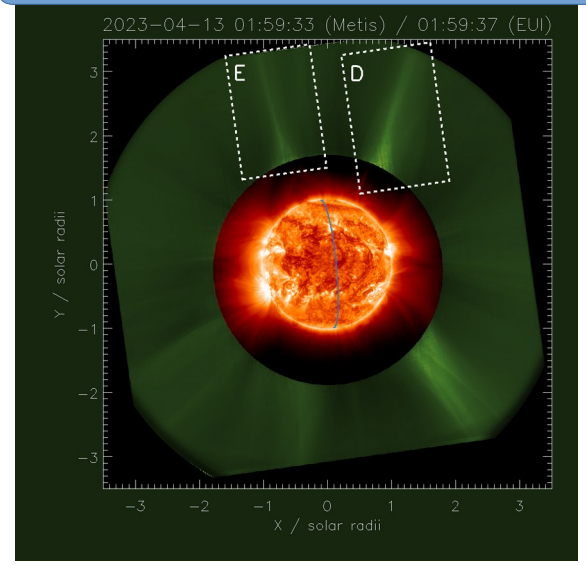


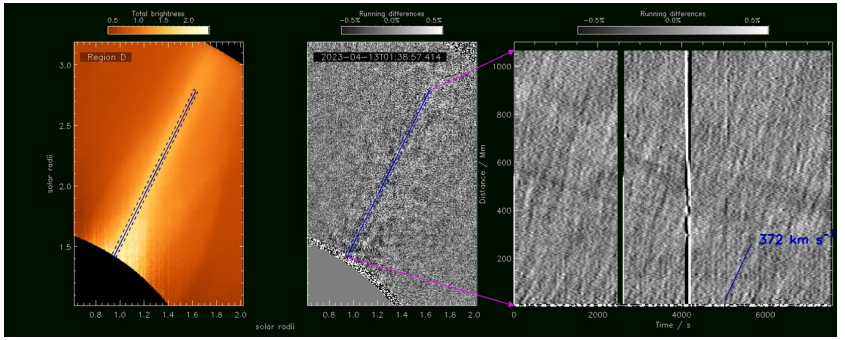


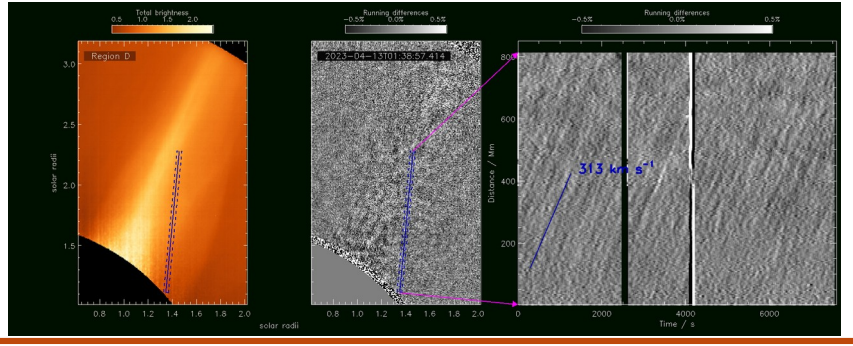


Time-distance diagrams: 3rd perihelion

13-04-2023 (**total duration: 125 min from two acquitisions of 41 and 82 min each**)

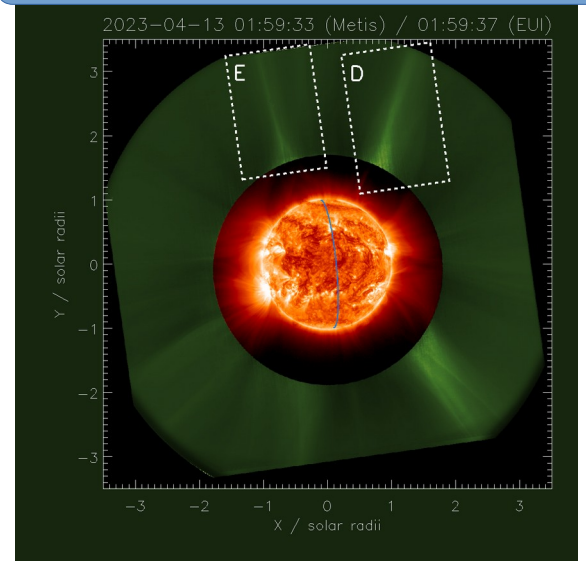


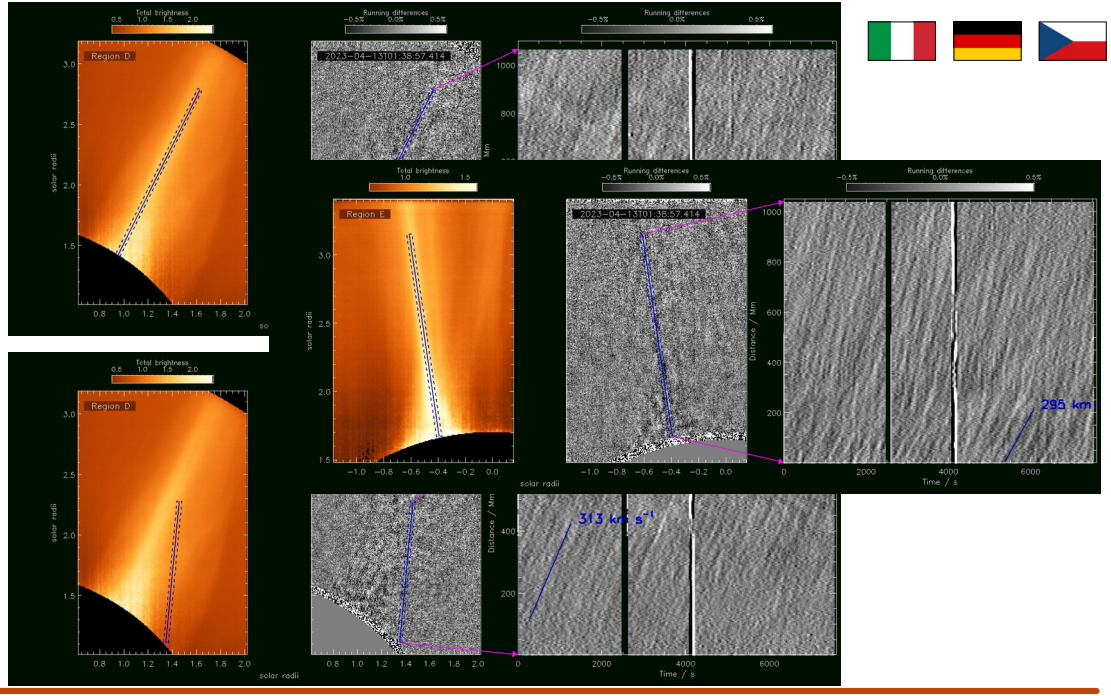




Time-distance diagrams: 3rd perihelion

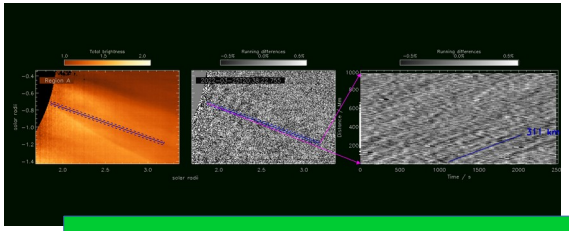
13-04-2023 (**total duration: 125 min from two acquitisions of 41 and 82 min each**)

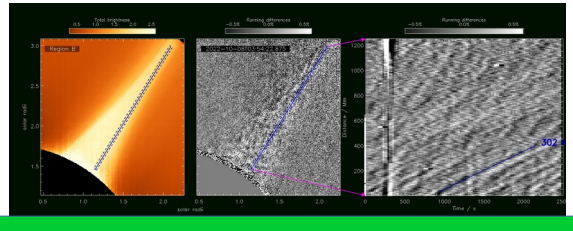




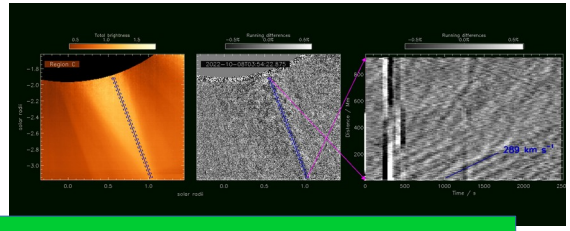
Time-distance diagrams: summary

25-03-2022 (duration: 41 min)

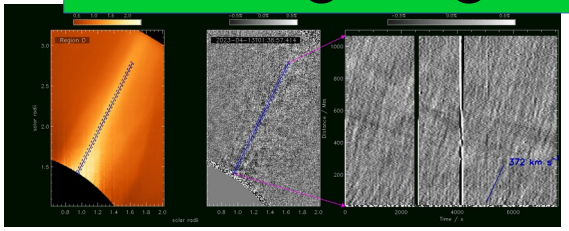


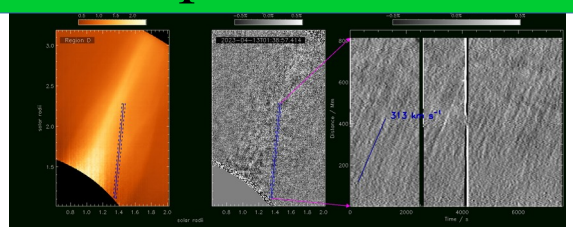


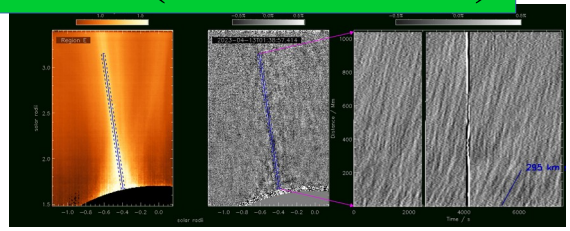
08-10-2022 (duration: 41 min)



Recurring “ridges” with a period of ~ 4 - 5 min (~ 3 - 4 mHz)

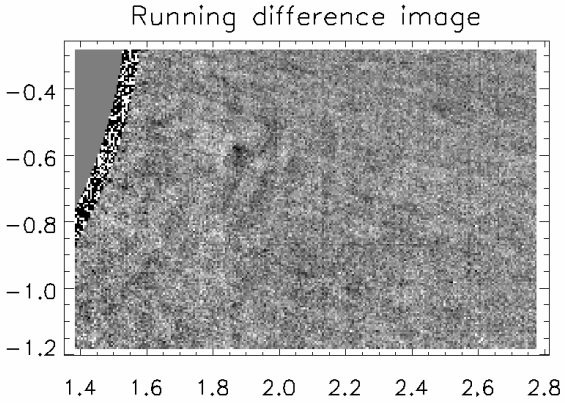


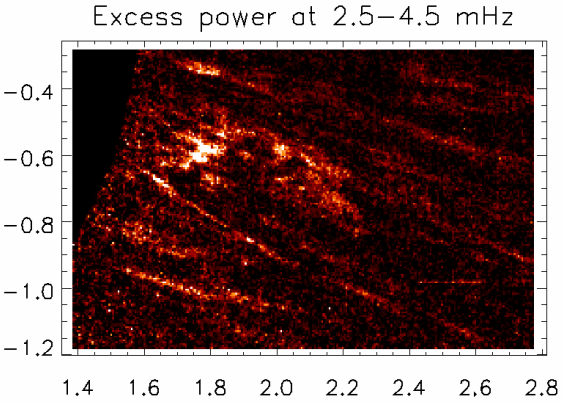




13-04-2023 (**total duration: 125 min from two acquitisions of 41 and 82 min each**)

Power enhancement at 3.5 mHz



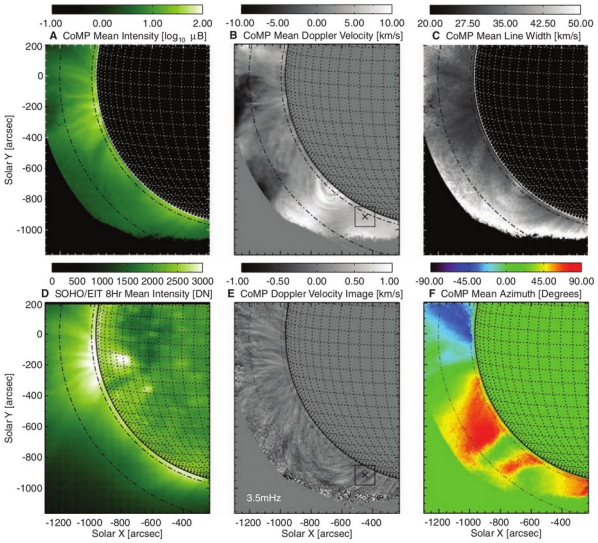


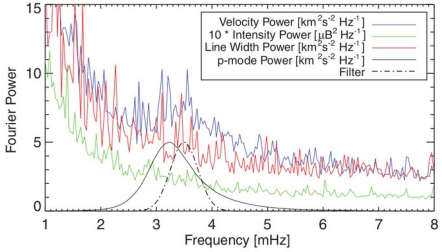


Properties of these periodic perturbations

- Periods: of the order of 4 - 5 min (3 - 4 mHz)
- Amplitudes: ~10^{-3} of background, roughly constant with height, at least till they disappear in the noise
- Phase speed: of the order of 200 – 400 km s^{-1}
- Coherent at least for the duration of the observations (up to 2 h). No sign of damping.
- Coherent over large volumes (several tens or even hundreds of Mm).
- Ubiquitous in bright, near-stationary structures, but detectable also elsewhere (see, e.g., region A on 2022-03-25).
- Detectable both in streamers and pseudo-streamers.
- Observed in the same structure for many days, for the duration of the high cadence program.

Have these periodicities been observed in corona before?



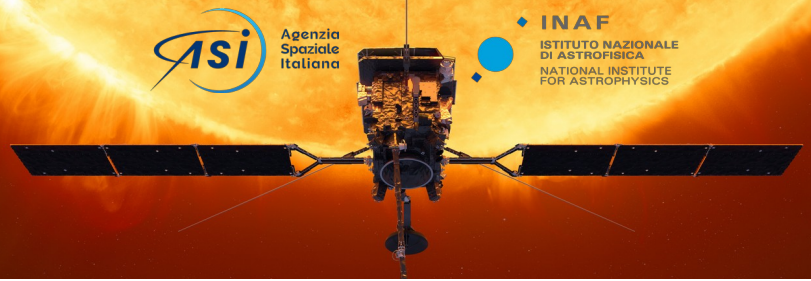


Tomczyk et al, Science (2007):

- Velocity perturbations (no signal in intensity)

Metis 5 min periodic perturbations:

- Electron density perturbations



Thank you for your attention