

The background of the slide is a composite image. On the left, the Metis satellite is shown in a 3D perspective, with its solar panels and various instruments visible. It is positioned as if observing the Sun. The Sun itself is a large, bright orange-yellow sphere on the right side of the image, with a highly textured, turbulent surface showing various solar features like sunspots and solar flares. The overall color palette is dominated by the warm tones of the Sun's corona and the dark space around the satellite.

9<sup>th</sup> Metis Workshop  
Catania (Italy)  
January 26<sup>th</sup>, 2024

## Waves in corona observed by Metis

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# Metis capabilities of high-cadence measurements



## Metis acquisition Schemes

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

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 <sup>(a)</sup>
	UV-PC-Offset	Photon counting offset mode
	UV-TN	Temporal noise acquisition

DIT > 20 s

DIT > 1 s

Antonucci et al. A10 (2020)





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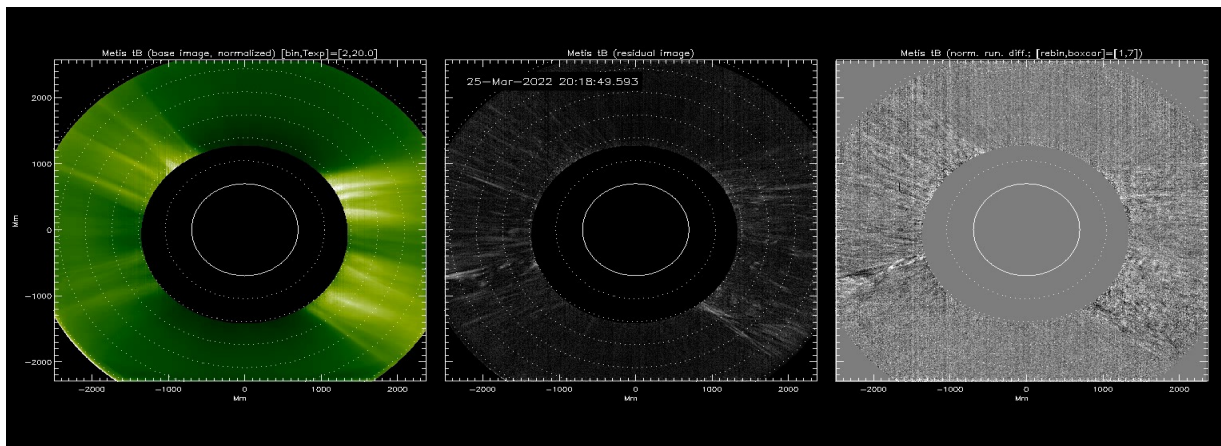
DIT > 1 s

Antonucci et al. A10 (2020)





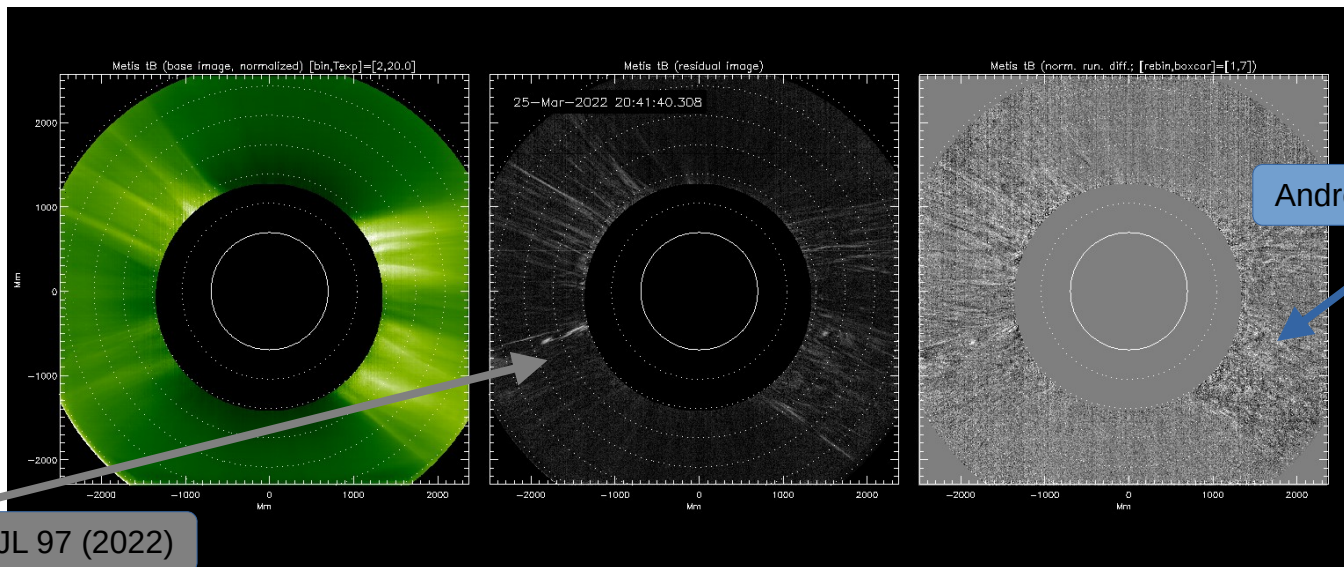
An example during the 1<sup>st</sup> perihelion of the nominal mission







An example during the 1<sup>st</sup> perihelion of the nominal mission



Andretta et al., in prep.

Telloni et al., ApJL 97 (2022)



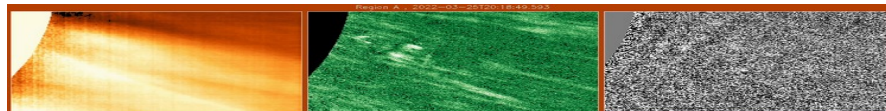
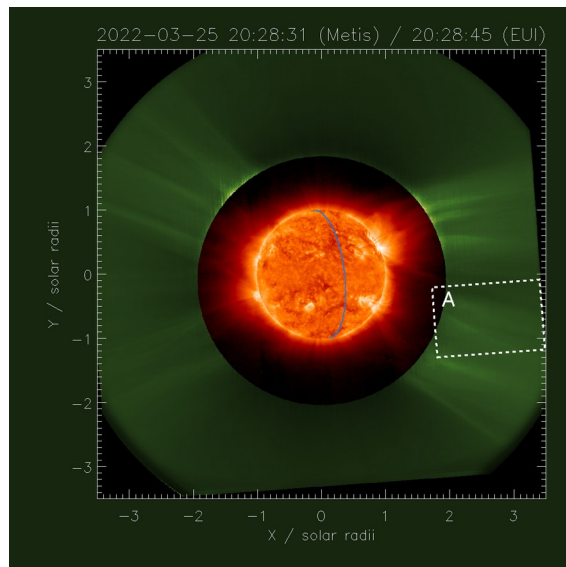


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## A closer look



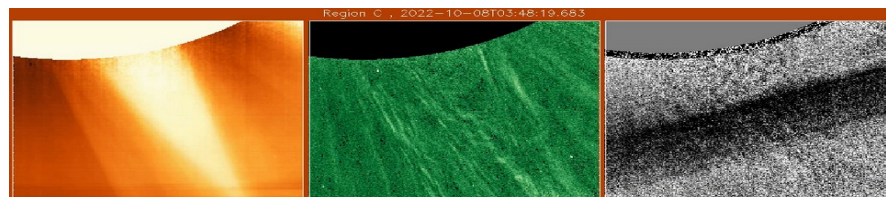
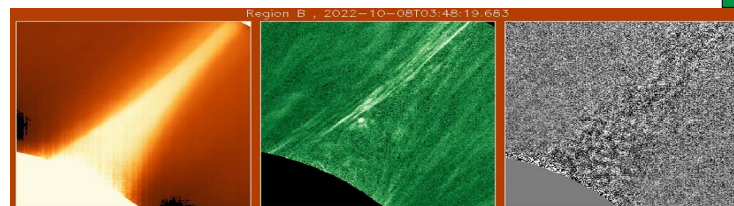
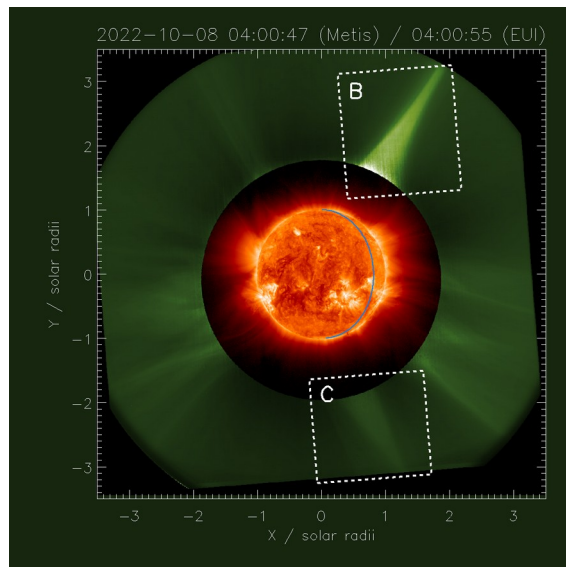


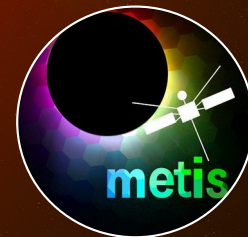
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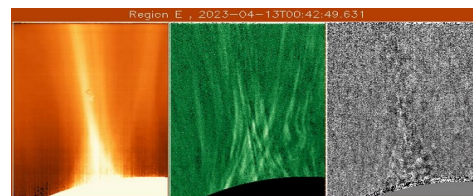
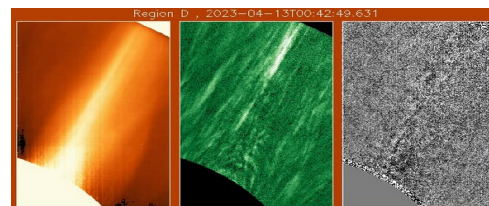
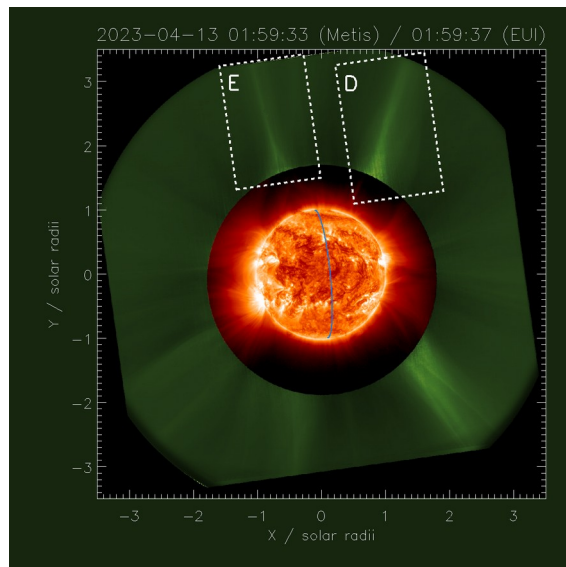


## Examples from selected regions of interest: 2<sup>nd</sup> perihelion





# Examples from selected regions of interest: 3<sup>rd</sup> perihelion





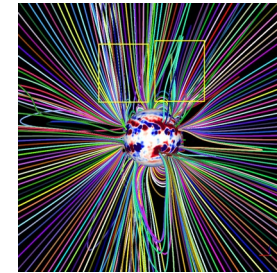
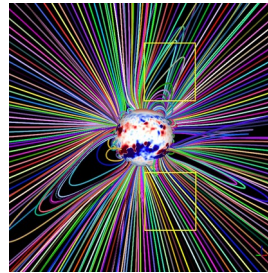
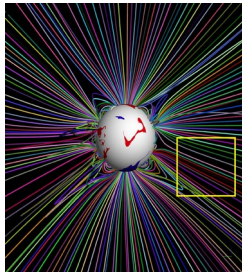
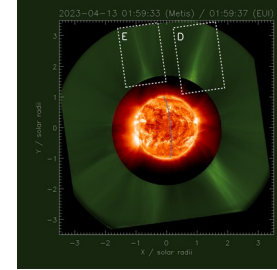
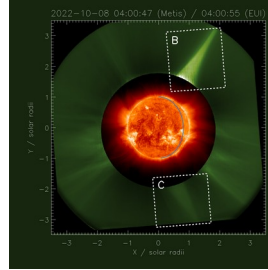
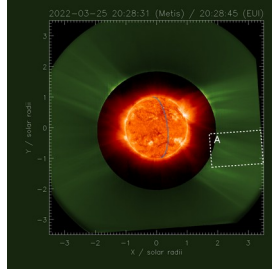


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# On the magnetic configurations in the regions of interest









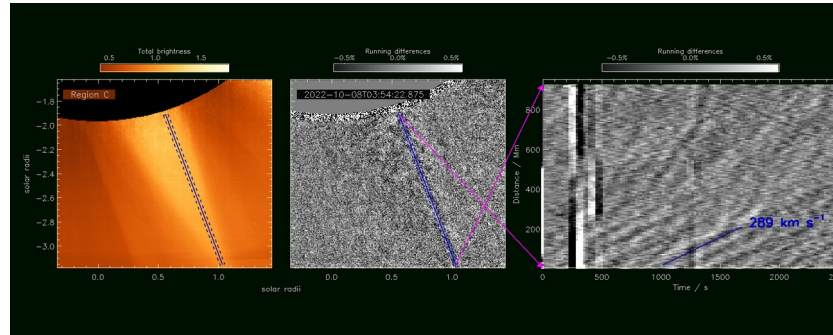
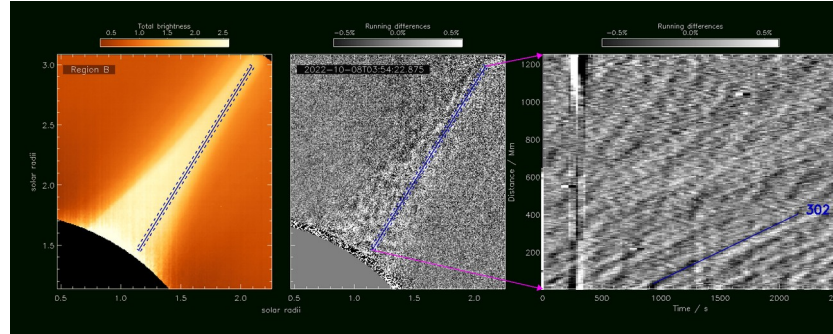
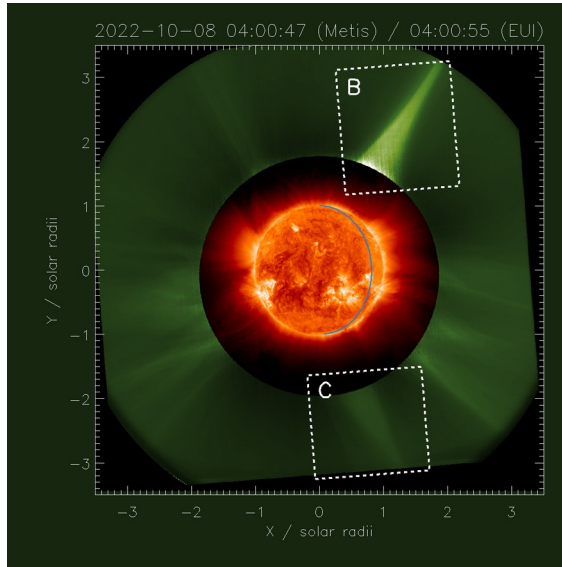
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## Time-distance diagrams: 2<sup>nd</sup> perihelion

08-10-2022 (duration: 41 min)







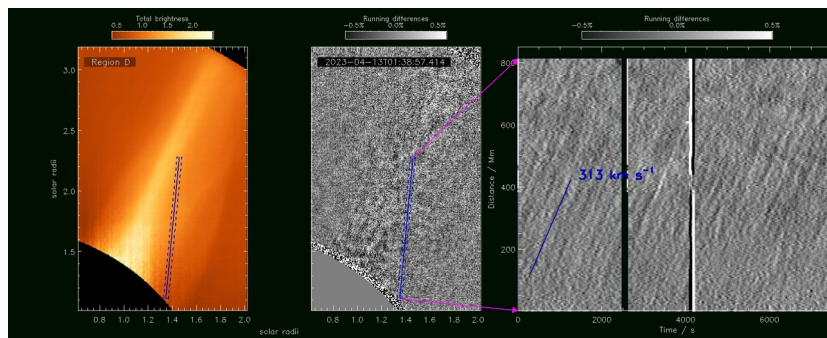
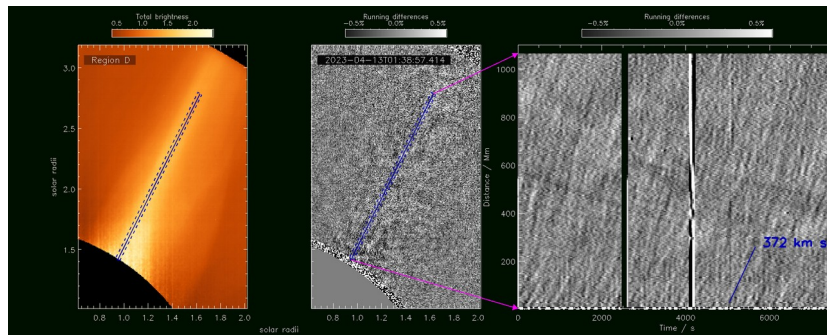
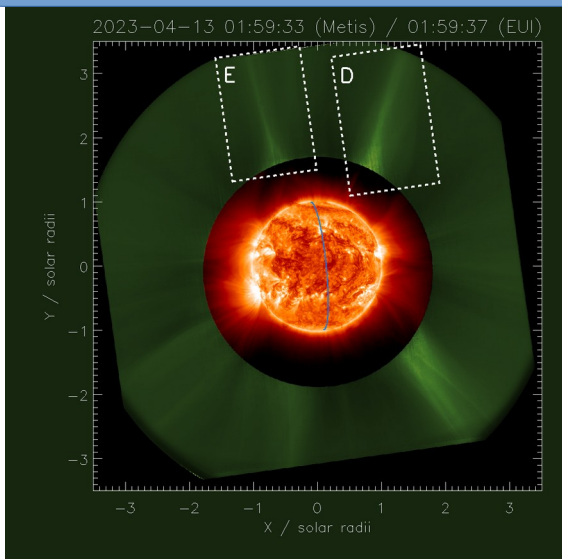
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## Time-distance diagrams: 3<sup>rd</sup> perihelion

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





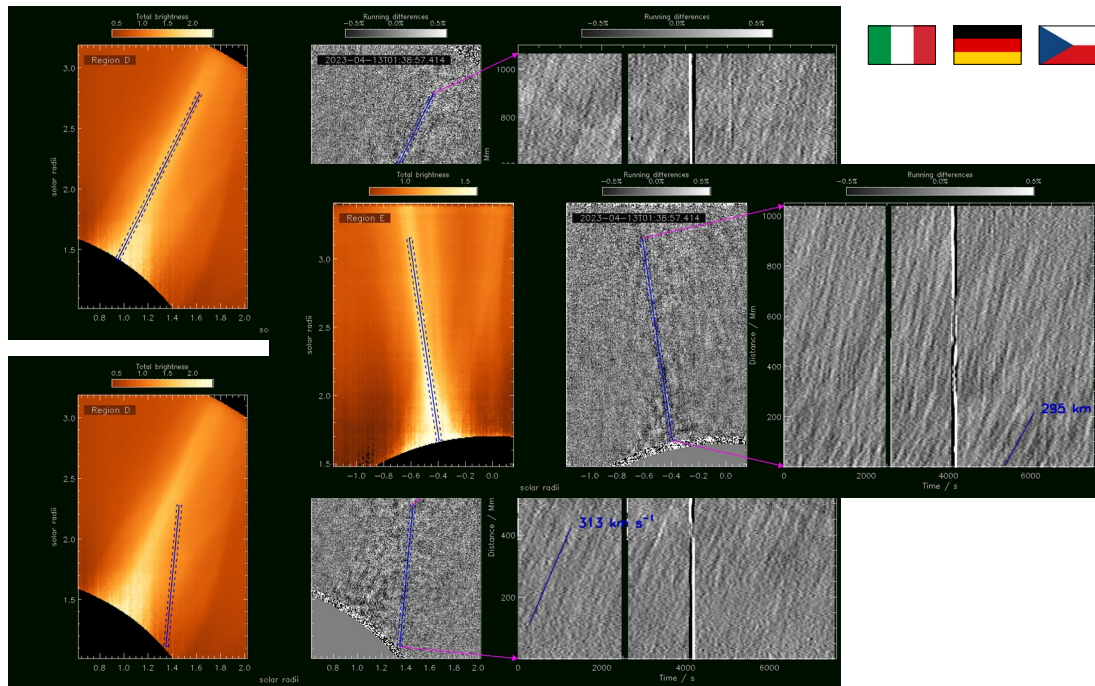
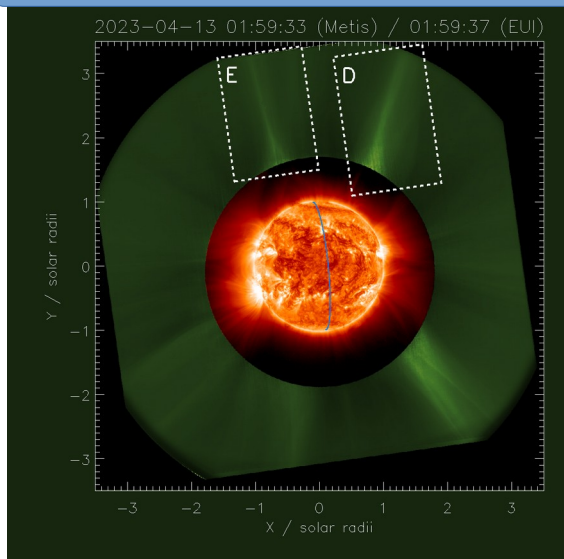
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## Time-distance diagrams: 3<sup>rd</sup> perihelion

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





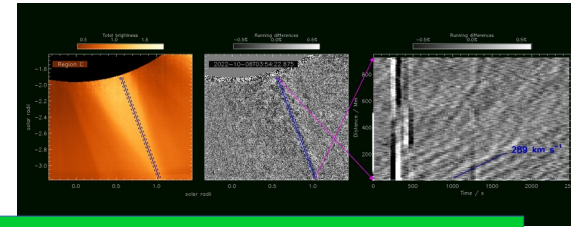
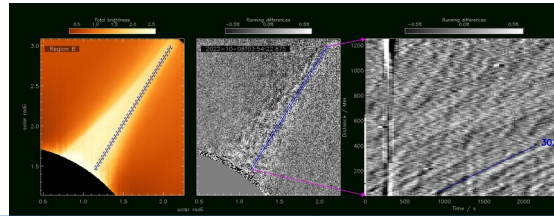
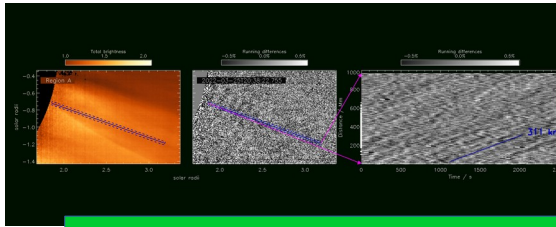


## Time-distance diagrams: summary

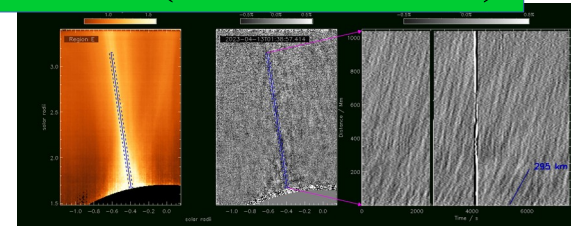
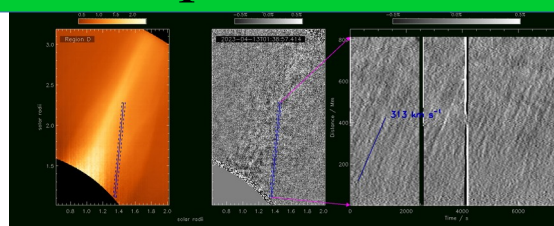
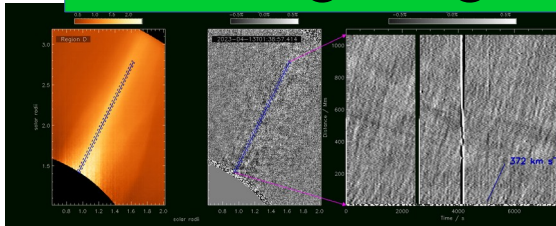


25-03-2022 (duration: 41 min)

08-10-2022 (duration: 41 min)



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



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

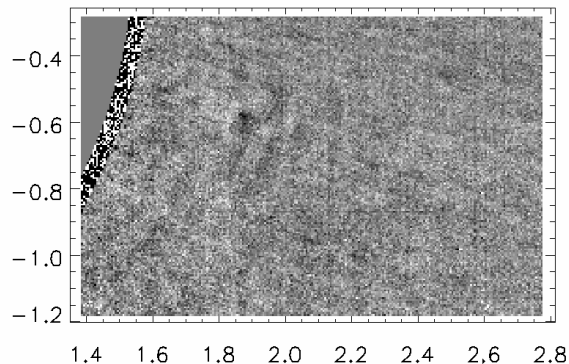




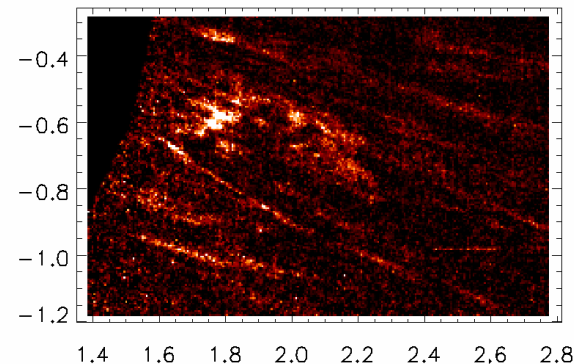
# Power enhancement at 3.5 mHz



Running difference image



Excess power at 2.5–4.5 mHz



2022-03-25T20:31:27.385



## Properties of these periodic perturbations

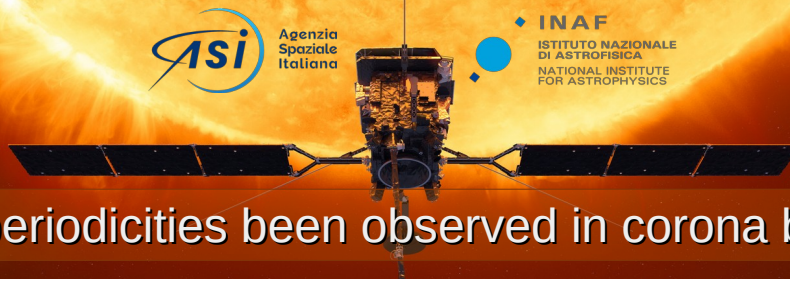
- Periods: of the order of 4 - 5 min (3 - 4 mHz)
- Amplitudes:  $\sim 10^{-3}$  of background, roughly constant with height, at least till they disappear in the noise
- Phase speed: of the order of 200 – 400 km s<sup>-1</sup>
- Coherent at least for the duration of the observations (up to 2 h). No sign 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.



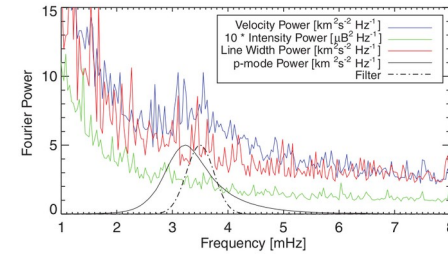
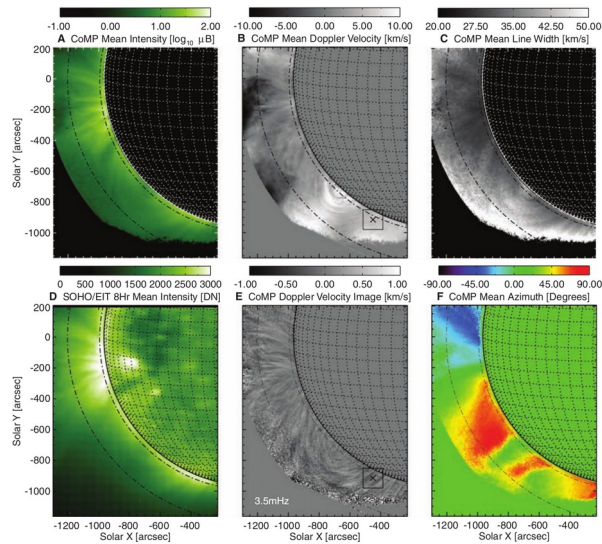


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Have these periodicities been observed in corona before?



Tomczyk et al, Science (2007):

- Velocity perturbations (no signal in intensity)

Metis 5 min periodic perturbations:

- Electron density perturbations





Thank you for your attention