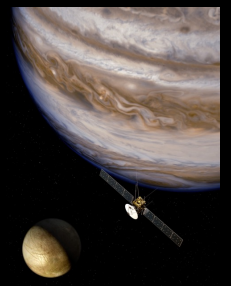
Acceleration and Transport of Solar Energetic Particles in the Inner Heliosphere


Solar Orbiter Credit: ESA


BepiColombo Credit: ESA

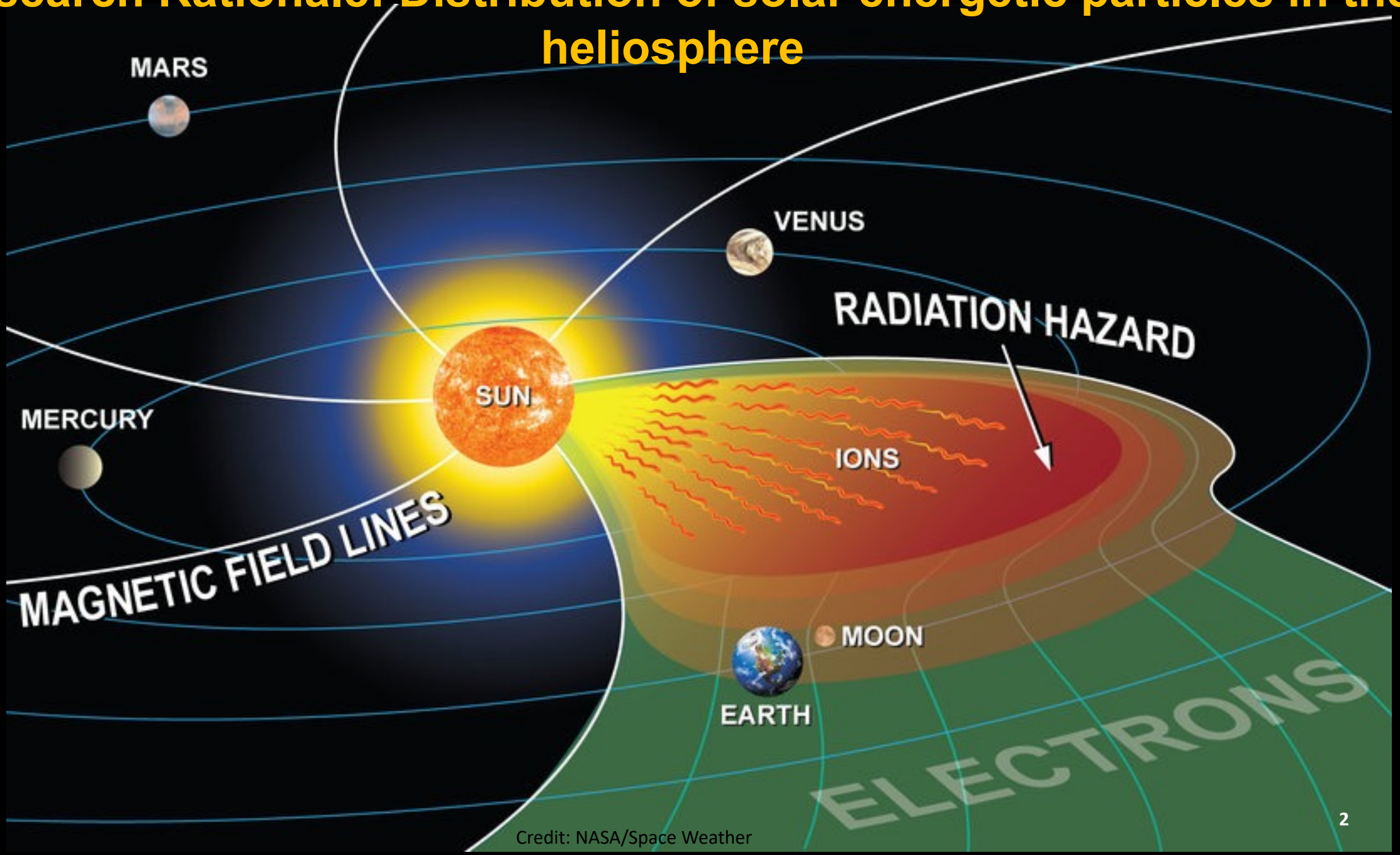

Parker Solar Probe Credit: NASA


JUICE Credit: ESA

Laura Rodríguez-García
ESA Research Fellow

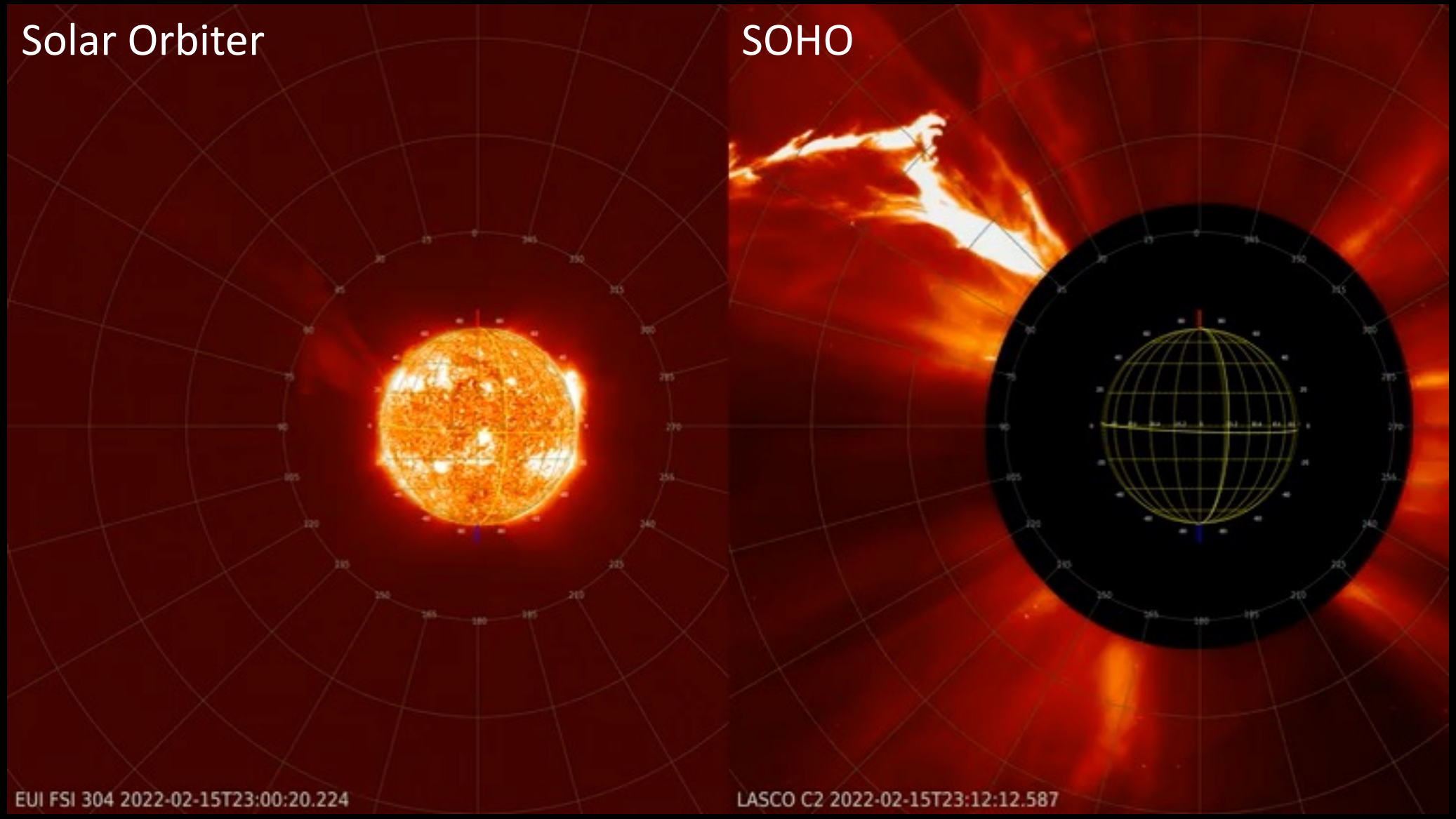
Solar Orbiter EPD (energetic particle detector) instrument team member
BepiColombo Cruise Science Study Group member
Parker Solar Probe working group member
SERPENTINE project member

Research Rationale: Distribution of solar energetic particles in the heliosphere



Credit: NASA/Space Weather

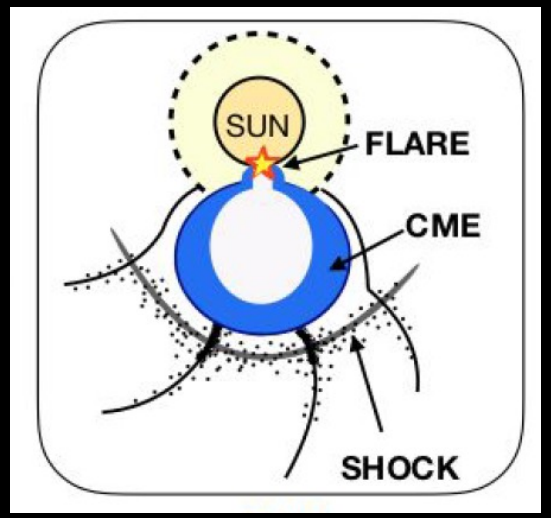
Solar activity: flares, coronal mass ejections (CMEs)



Composition of imagery from the ESA/NASA Solar Orbiter and SOHO spacecraft, which captured a giant solar eruption on 15 February 2022

Solar energetic particle events (SEPs)

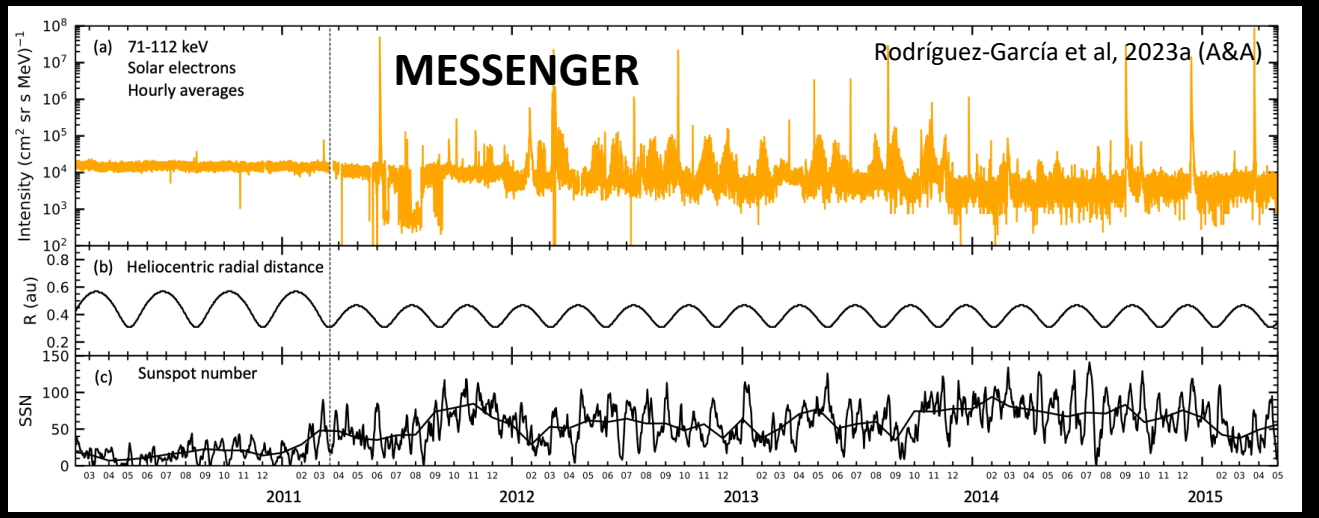
Solar activity



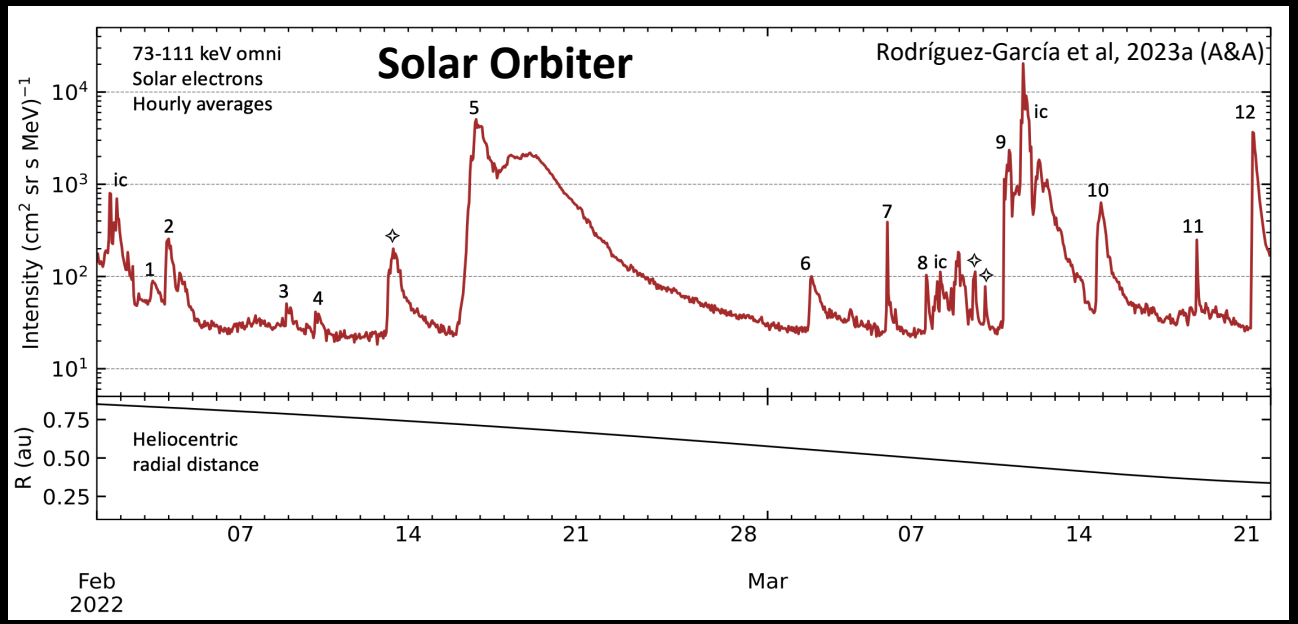
Credit: Rami Vainio and Nina Dresing

Increase of solar energetic particles measured in situ

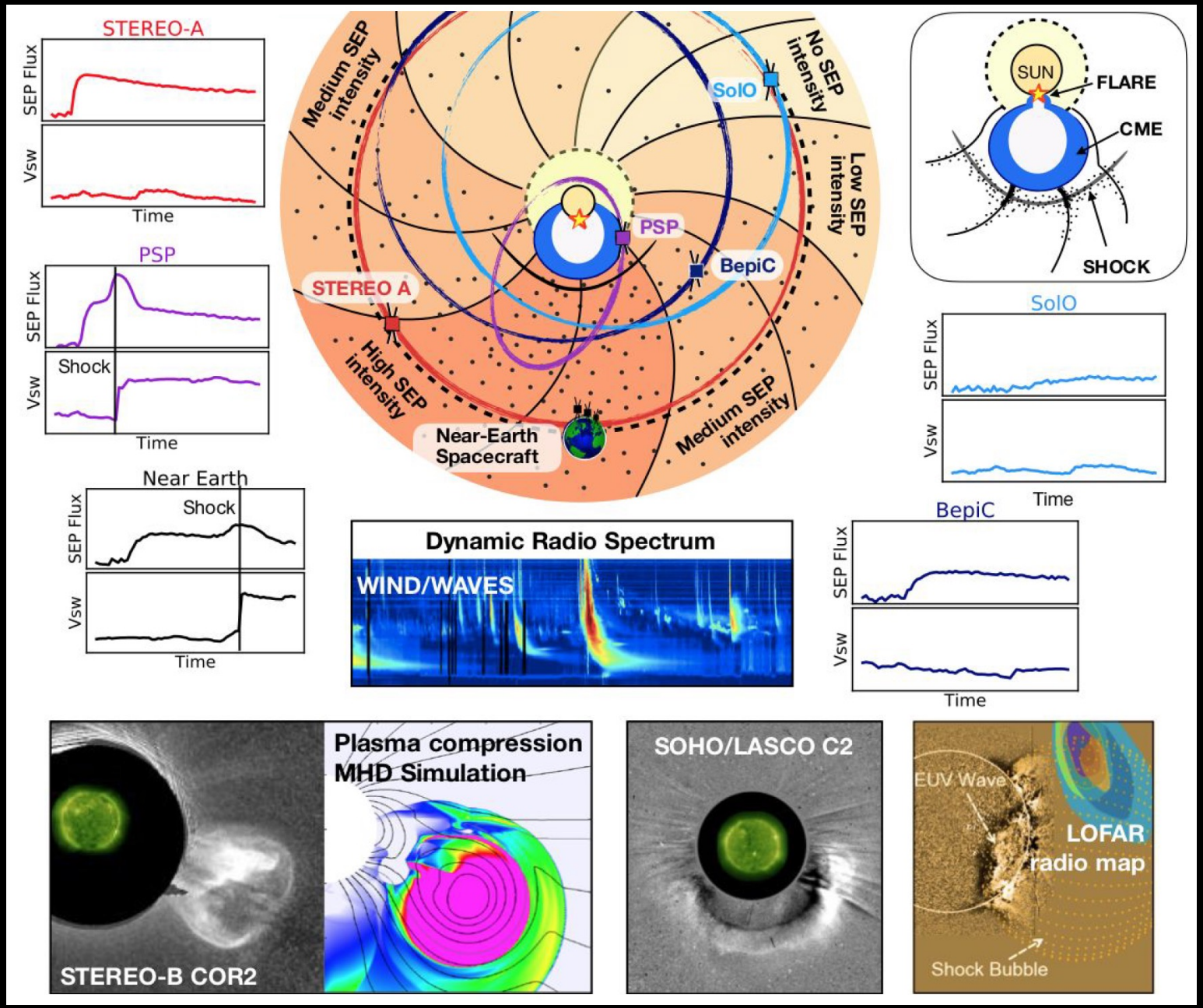
Planetary mission



Heliophysics mission



Widespread solar energetic particle (SEP) events



Credit: Rami Vainio and Nina Dresing

Previous results

A&A 653, A137 (2021)

The unusual widespread solar energetic particle event on 2013 August 19

Solar origin and particle longitudinal distribution*

L. Rodríguez-García[1], R. Gómez-Herrero[1], I. Zouganelis[2], L. Balmaceda[3,4], T. Nieves-Chinchilla[3], N. Dresing[5,6], M. Dumbović[7], N. V. Nitta[8], F. Carcaboso[1], L. F. G. dos Santos[9], L. K. Jian[3], L. Mays[3], D. Williams[2] and J. Rodríguez-Pacheco[1]

A&A 662, A45 (2022)

Evidence of a complex structure within the 2013 August 19 coronal mass ejection

Radial and longitudinal evolution in the inner heliosphere*

L. Rodríguez-García[1], T. Nieves-Chinchilla[2], R. Gómez-Herrero[1], I. Zouganelis[3], A. Vourlidas[4], L. A. Balmaceda[2,5], M. Dumbović[6], L. K. Jian[2], L. Mays[2], F. Carcaboso[1,2,7], L. F. G. dos Santos[8] and J. Rodríguez-Pacheco[1]

A&A 670, A51 (2023)

Solar energetic electron events measured by MESSENGER and Solar Orbiter

Peak intensity and energy spectrum radial dependences: Statistical analysis*

L. Rodríguez-García[1], R. Gómez-Herrero[1], N. Dresing[2], D. Lario[3], I. Zouganelis[4], L. A. Balmaceda[3,5], A. Kouloumvakos[6], A. Fedeli[2], F. Espinosa Lara[1], I. Cernuda[1], G. C. Ho[6], R. F. Wimmer-Schweingruber[7] and J. Rodríguez-Pacheco[1]

A&A 674, A145 (2023)

Solar activity relations in energetic electron events measured by the MESSENGER mission

L. Rodríguez-García[1], L. A. Balmaceda[2,3], R. Gómez-Herrero[1], A. Kouloumvakos[4], N. Dresing[5], D. Lario[3], I. Zouganelis[6], A. Fedeli[5], F. Espinosa Lara[1], I. Cernuda[1], G. C. Ho[4], R. F. Wimmer-Schweingruber[7] and J. Rodríguez-Pacheco[1]

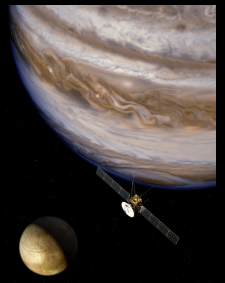
- ✓ **Both flare and shock-related processes** may contribute to the acceleration of near relativistic electrons in large solar energetic electron events

- ✓ **On average and within the uncertainties, we find a radial dependence of the peak intensities of the energetic electrons consistent with R^{-3}**

Research Fellowship Goals

(all relevant to Space Weather)

From inner to outer scales



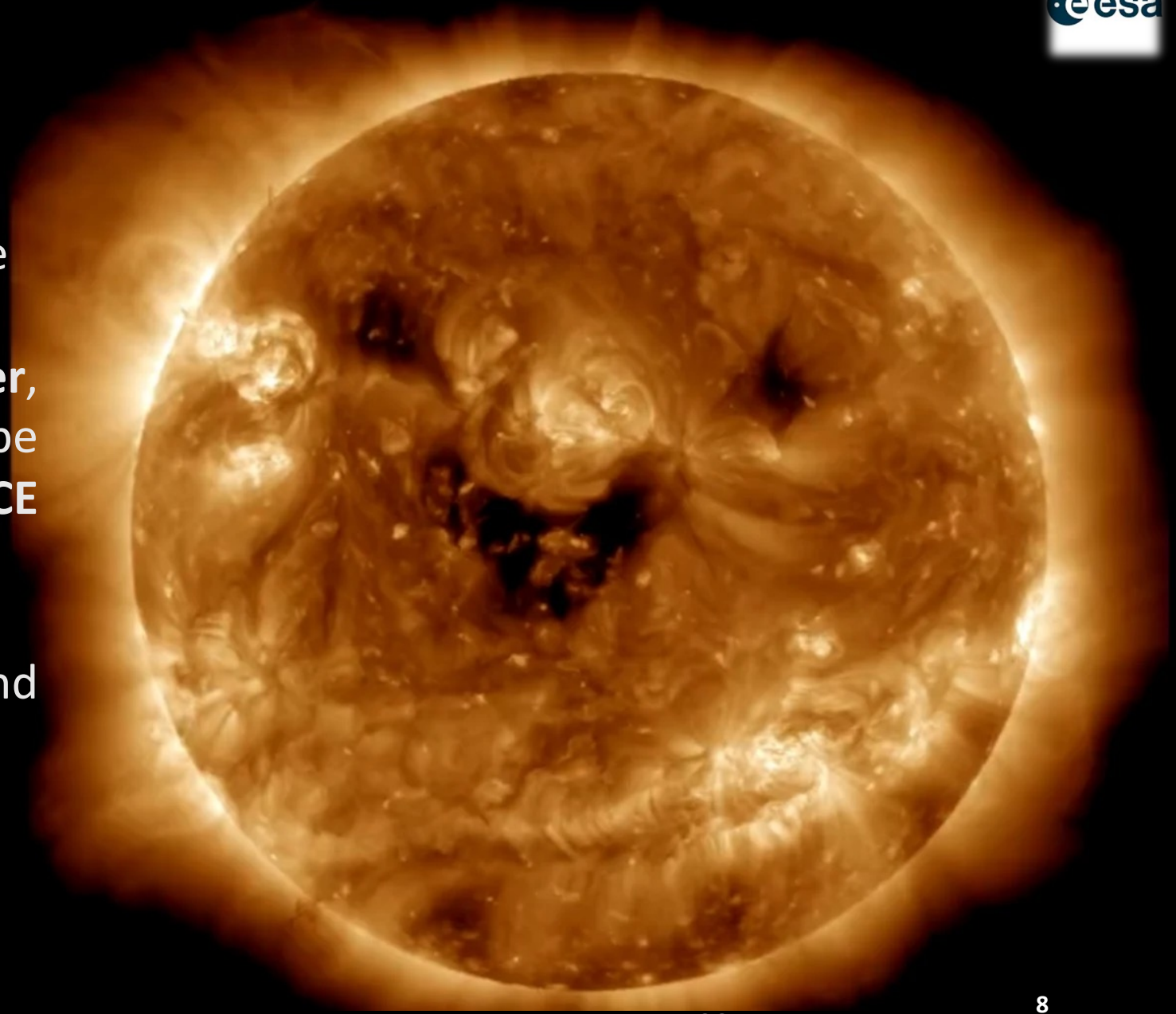
- To disentangle solar acceleration and transport effects

- Radial evolution of the particle properties

- Longitudinal evolution with radial distance

Take home message

- ✓ The Sun is active
- ✓ Energetic particles fill the heliosphere
- ✓ Missions such as **Solar Orbiter**, **BepiColombo**, and Parker Solar Probe are making the difference (and **JUICE** will make it ☺)
- ✓ Excited to go on with my research and to be part of **ESA**



Thank you for listening!

Laura Rodríguez-García
ESA Research Fellow