LDE3 Weekly Flare Bulletin

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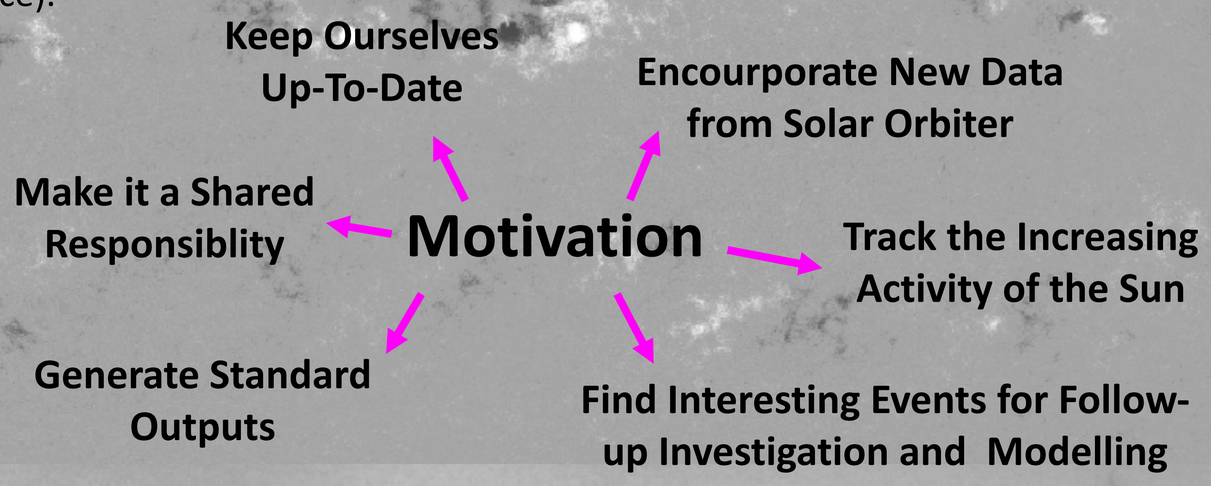
Since July 2021, we have maintained a **weekly activity bulletin** (the responsibility is passed around the LDE3 group, with each of us adding something different, based on our experience).



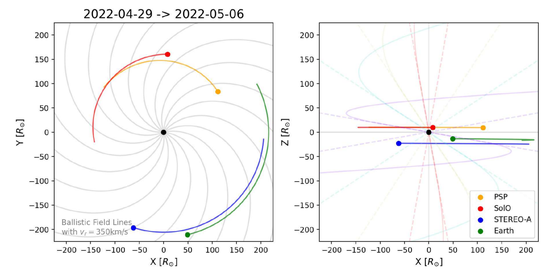
In order to facilitate this, **we developed a set of Python Tools to streamline creation of the Weekly Bulletin**. The Bulletin is sent out to a mailing list each Friday. **If you are interested in receiving these activity Bulletins, get in contact and we will add you to the mailing list.**

Example Bulletin (29th April – 6th May 2022):

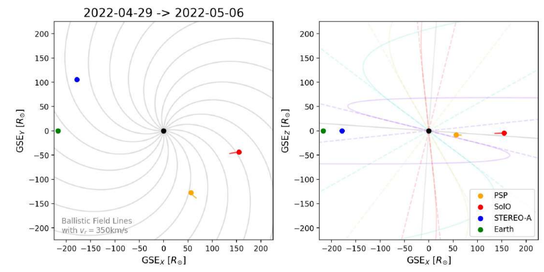
Weekly summary of spacecraft locations (notification of alignments and perihelion passes), x-ray activity as observed by both **Earth (GOES) and Solar Orbiter (STIX)**, up-to-date flare locations from the HEK and STIX Flare Locator, with discussion and highlights on interesting events.

SC Orbits

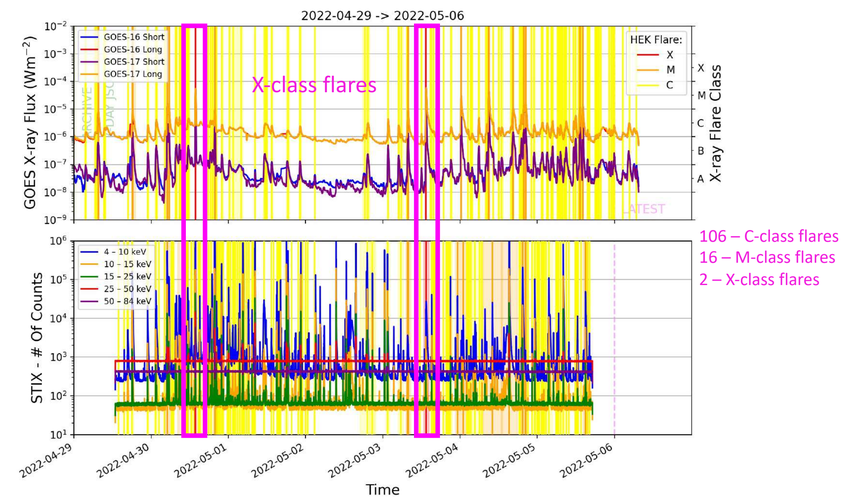
Carrington Frame (solar surface is fixed)



Earth-Sun Frame (Sun-Earth axis is fixed, with Earth on the left)



X-ray Data from GOES and STIX

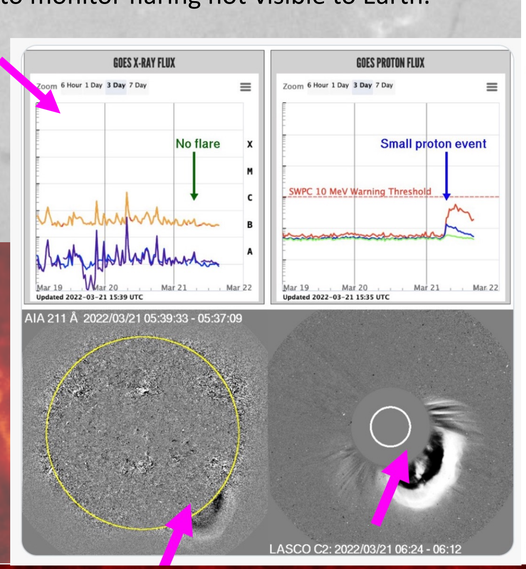


106 – C-class flares
16 – M-class flares
2 – X-class flares

STIX Flare Locator Data in Action!

Since its gravity assist with Earth in November, the field of view of Solar Orbiter has separated from that of Earth. This has allowed STIX, the x-ray instrument onboard Solar Orbiter, to monitor flaring not-visible to Earth.

This has already been useful in locating sources of Coronal Mass Ejections with no apparent flare.



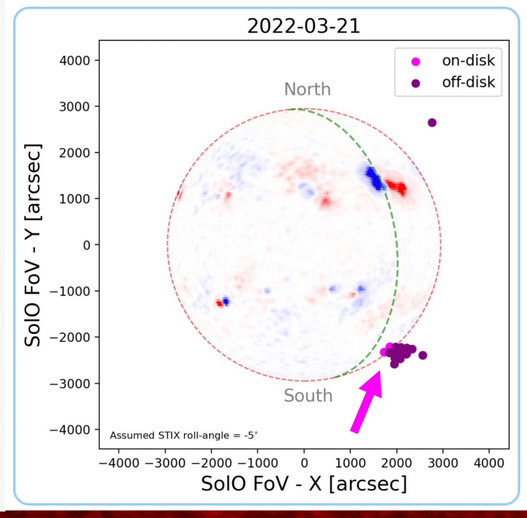
The orbital configuration of Solar Orbiter and Earth now has Solar Orbiter monitoring the x-ray activity on the back-side of the Sun, with observations rapidly available on the STIX website.

Over the last few weeks we have been able to track a large AR region from the Earth-side to the back-side (see below), and hopefully we will see it return!

Rui P @RuipSol **(21st March 2022)**

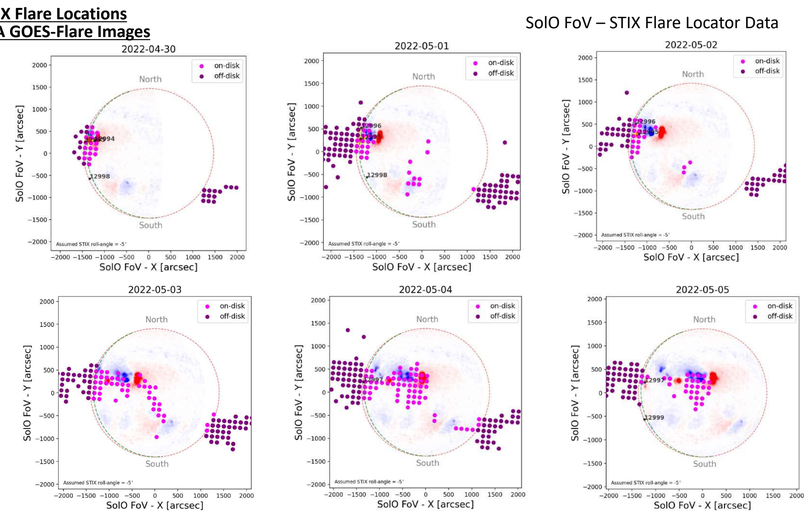
Replying to @RuipSol and @halocme

and this is where we think the flare occurred (using @stix_so coarse flare location data and some python magic by @AdamF_Astro). The green dashed line is the solar limb as seen from Earth (red: limb as seen by @ESASolarOrbiter). Pretty consistent with LASCO images.



STIX Flare Locations
AIA GOES-Flare Images

SolO FoV – STIX Flare Locator Data



A Recent Snapshot

Here is a summary of the x-ray activity on the Sun from the **6th May** using our ever-developing pipeline:

Earth visible Flares are retrieved from the Heliospheric Event Knowledgebase, and overlayed as coloured crosses on the visible EUV emission (AIA-193A).

Currently, **STEREO-A** has a vantage point of upcoming activity. We display the observed EUV emission (EUVI-193A).

Solar Orbiter is monitoring the back-side of the Sun. Here we show the most recent ADAPT magnetogram (observed field + time-evolution) as viewed from the position of Solar Orbiter. The STIX Flare Locator Data, available from the STIX website, is then overplotted with coloured points.

In this configuration, we can monitor flare activity over the entire Sun. This snapshot, shows that a large AR (previously visible from Earth) has continued to produce **flares on the back-side**. This region is also visible in SDO Helioseismic inversions, another product which could be, in future, encorporated into the weekly Bulletin.

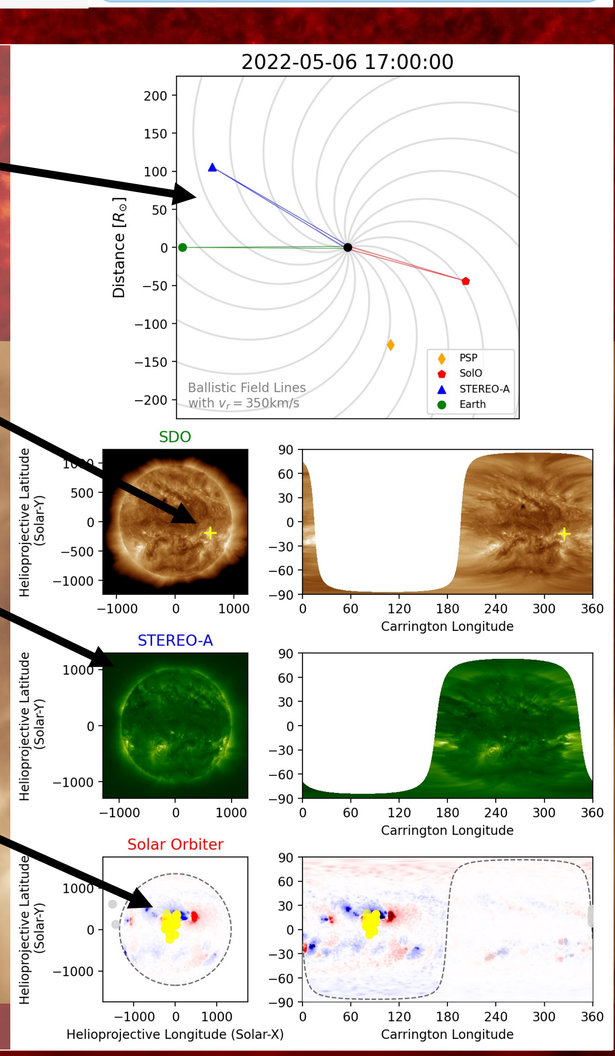
Summary of Spacecraft Locations (with respect to Earth)

Remote-observing Fields of View

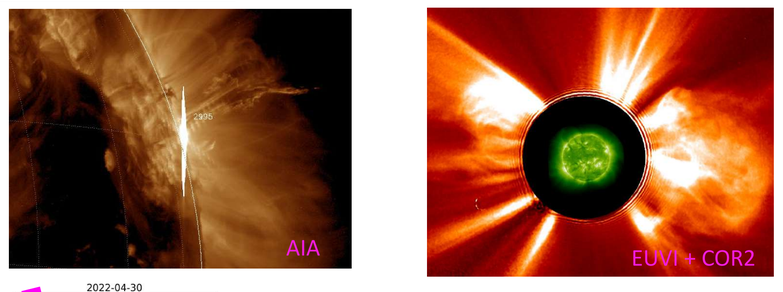
Earth-visible C-class Flare

Alternative View from STEREO-A

Tracking Flares on the back-side of the Sun with the STIX instrument onboard Solar Orbiter

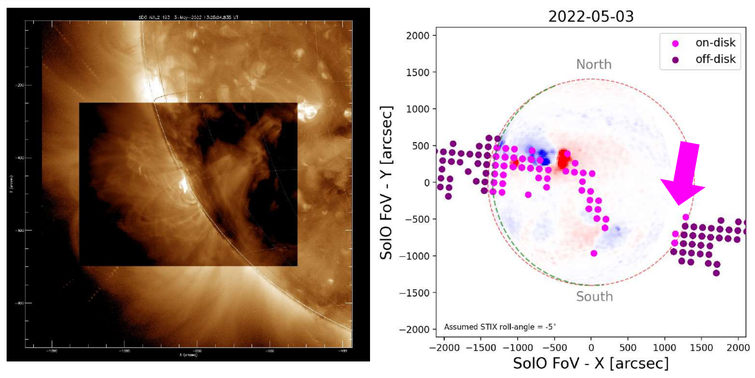


Focus on the X-class flare on April 30th



X1.1-class flare at 13:47 UTC
Produced by NOAA AR 2994
CME associated at 14:00 UTC,
but not likely to be geo-effective

Focus on the X-class flare on May 3rd



X1.1-class flare at 13:25 UTC
Source not completely identified yet
Caused high-frequency communication blackouts over the Atlantic ocean

We compile observations from multiple spacecraft/observatories in space and on the ground. These include; the Solar Dynamics Observatory (SDO), Solar and Heliospheric Observatory (SOHO), Solar Terrestrial Relations Observatory (STEREO-A), Solar Orbiter (SolO), the Global Oscillation Network Group (GONG), Hinode X-ray Telescope, Kanzelhoehe Solar Observatory (KSO), and others.

To produce the bulletin we leverage many existing software packages and data repositories. These include; the Heliospheric Event Knowledgebase, the **SunPy** python package, the **stixdcpy** python package, and ESA JHelioviewer.