Polarimeter to Unify the Corona and Heliosphere

Science Operations Center Development

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PUNCH Science Meeting 6
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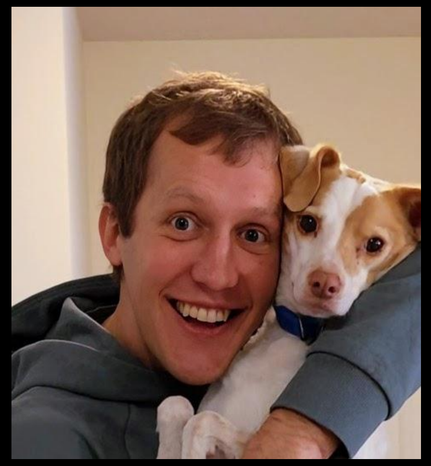
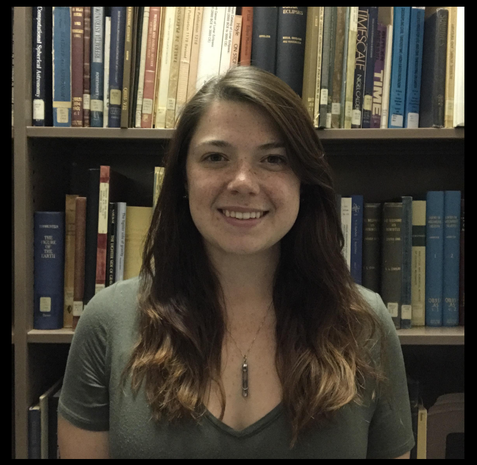


Sam Van Kooten

Chris Lowder

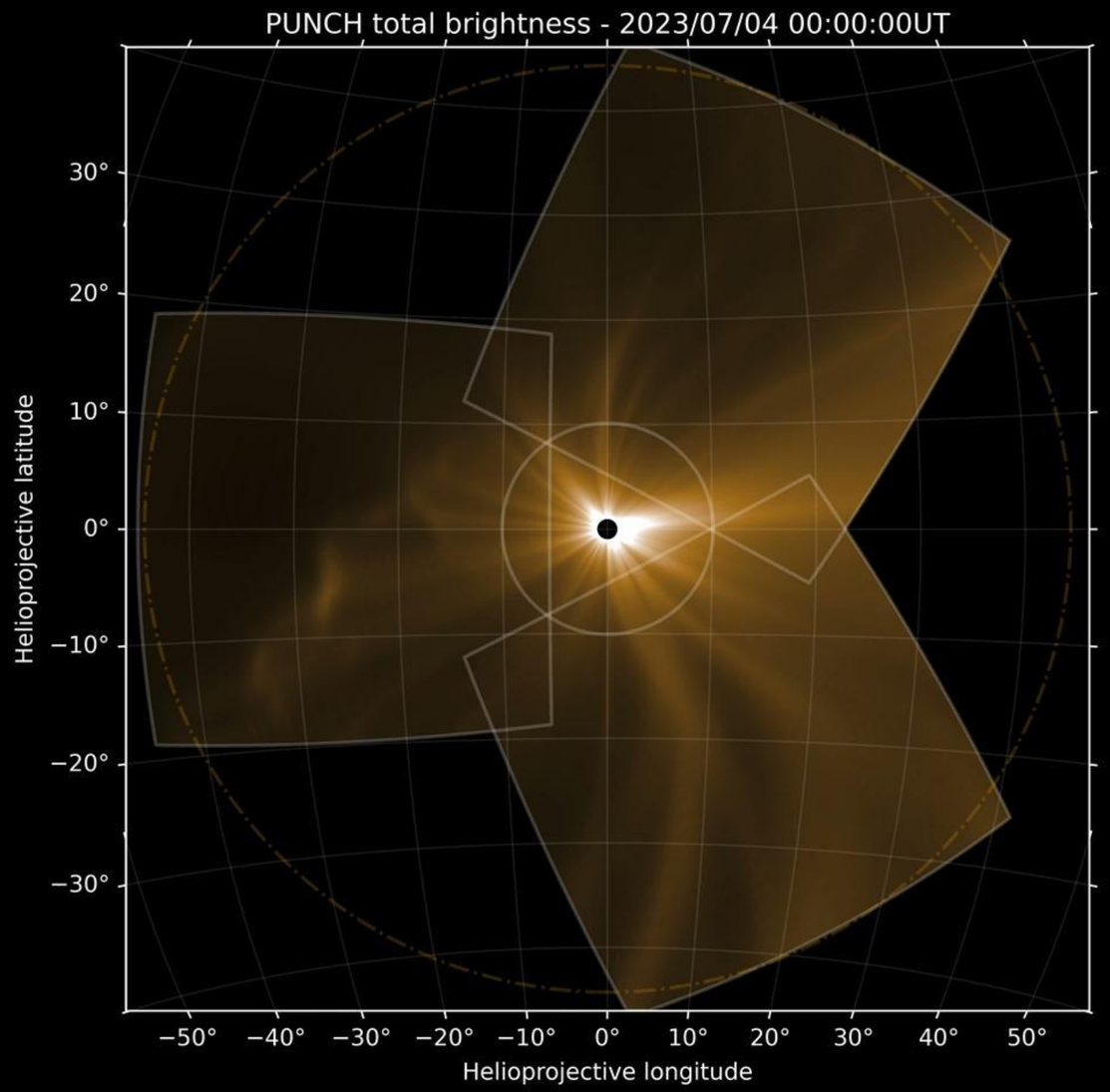


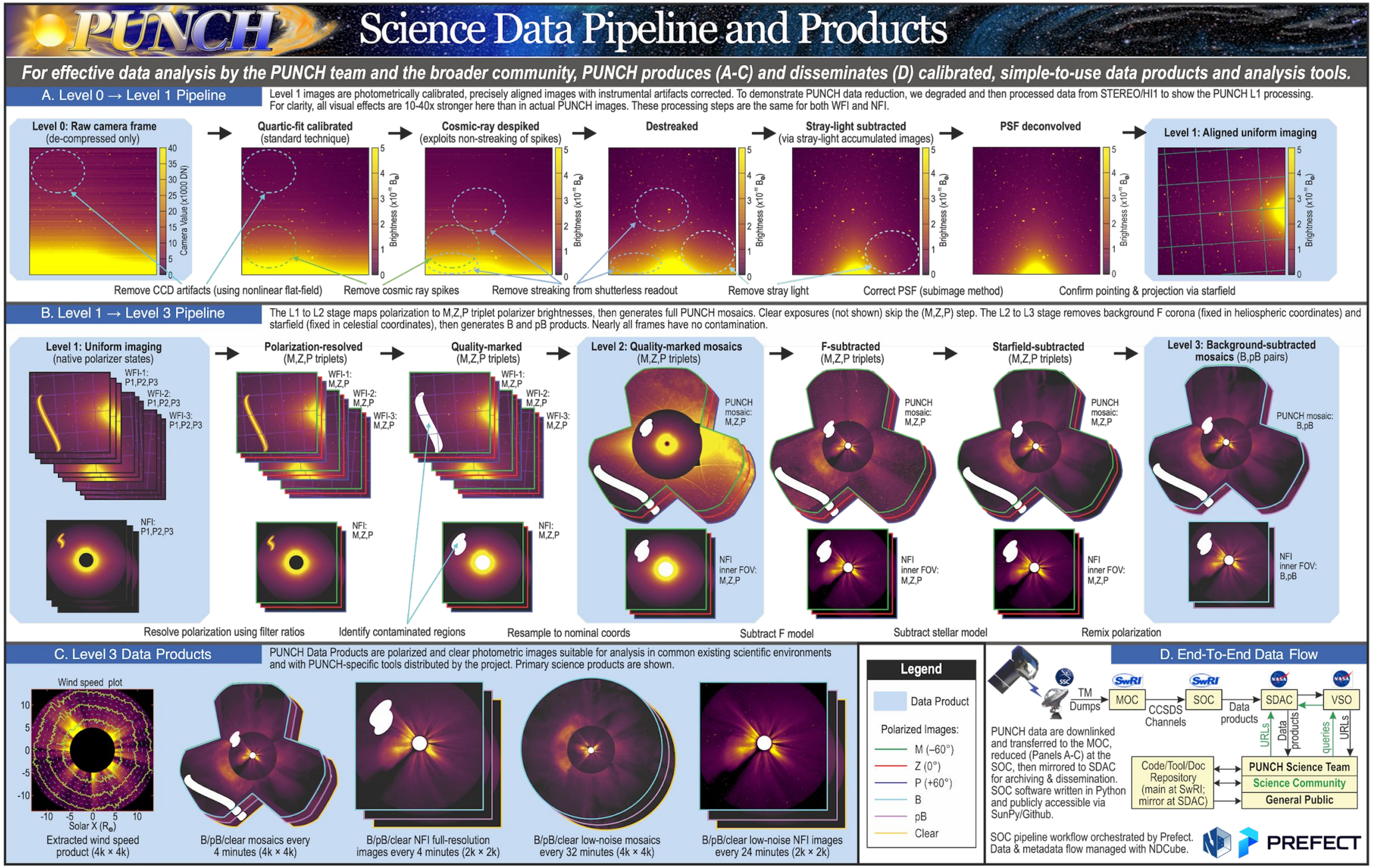
Sarah Kovac

Matt West

Many Observations Make Combined Virtual Observatory

- PUNCH observes continuously at 4-min. cadence
- NFI covers 5.4–32 $R_\odot$
- WFI covers 20–180 $R_\odot$
  3 separate segments
- PUNCH produces 3 full mosaics per orbit, from 6-180 $R_\odot$





Original figures and layout from PUNCH CSR

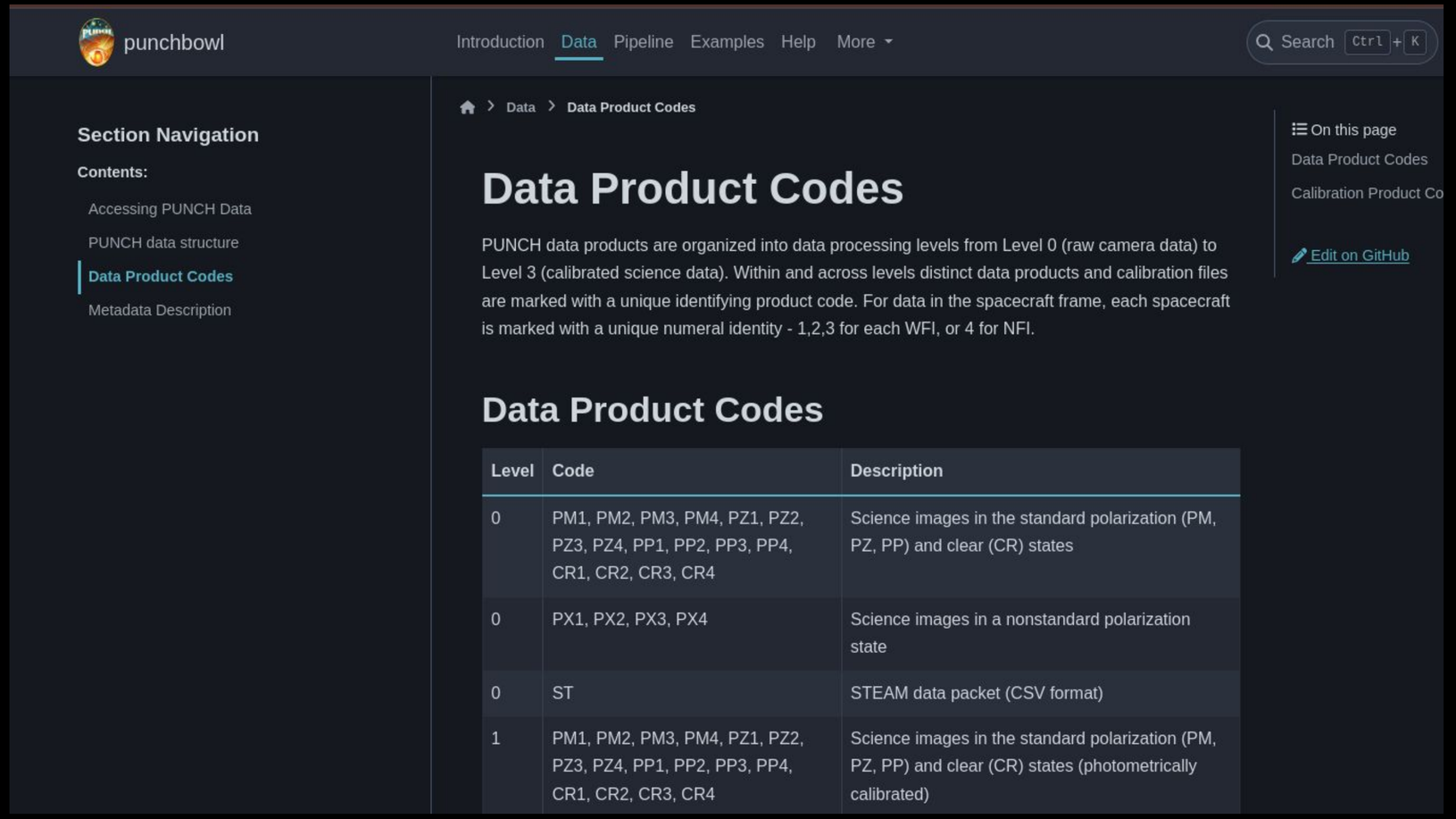
L3 Products Levels 2 & 3 Level 1

What are the Data Products?

Data products are described by level and product code:

L0_PM1: Level 0, Polarized Minus WFI-1

Full list of codes available in the punchbowl documentation (as shown on right)



Level	Code	Description
0	PM1, PM2, PM3, PM4, PZ1, PZ2, PZ3, PZ4, PP1, PP2, PP3, PP4, CR1, CR2, CR3, CR4	Science images in the standard polarization (PM, PZ, PP) and clear (CR) states
0	PX1, PX2, PX3, PX4	Science images in a nonstandard polarization state
0	ST	STEAM data packet (CSV format)
1	PM1, PM2, PM3, PM4, PZ1, PZ2, PZ3, PZ4, PP1, PP2, PP3, PP4, CR1, CR2, CR3, CR4	Science images in the standard polarization (PM, PZ, PP) and clear (CR) states (photometrically calibrated)

What are the Data Products?

Level 0: Almost straight from the satellite, no calibrations applied

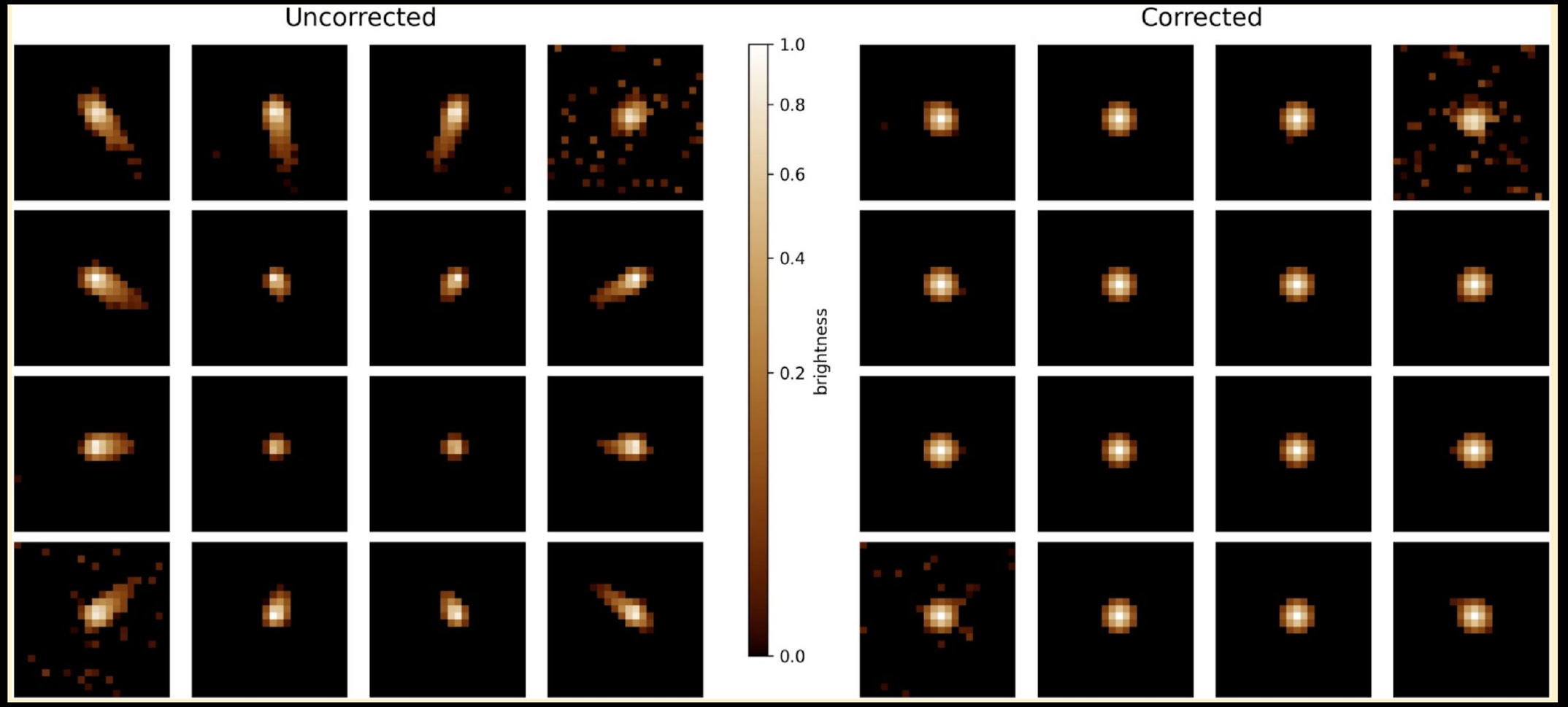
Level 1: Photometrically calibrated

Level 2: Trefoils with polarization resolved

Level 3: Highly calibrated images (stars and F-corona removed) including wind speed maps and low noise mosaics

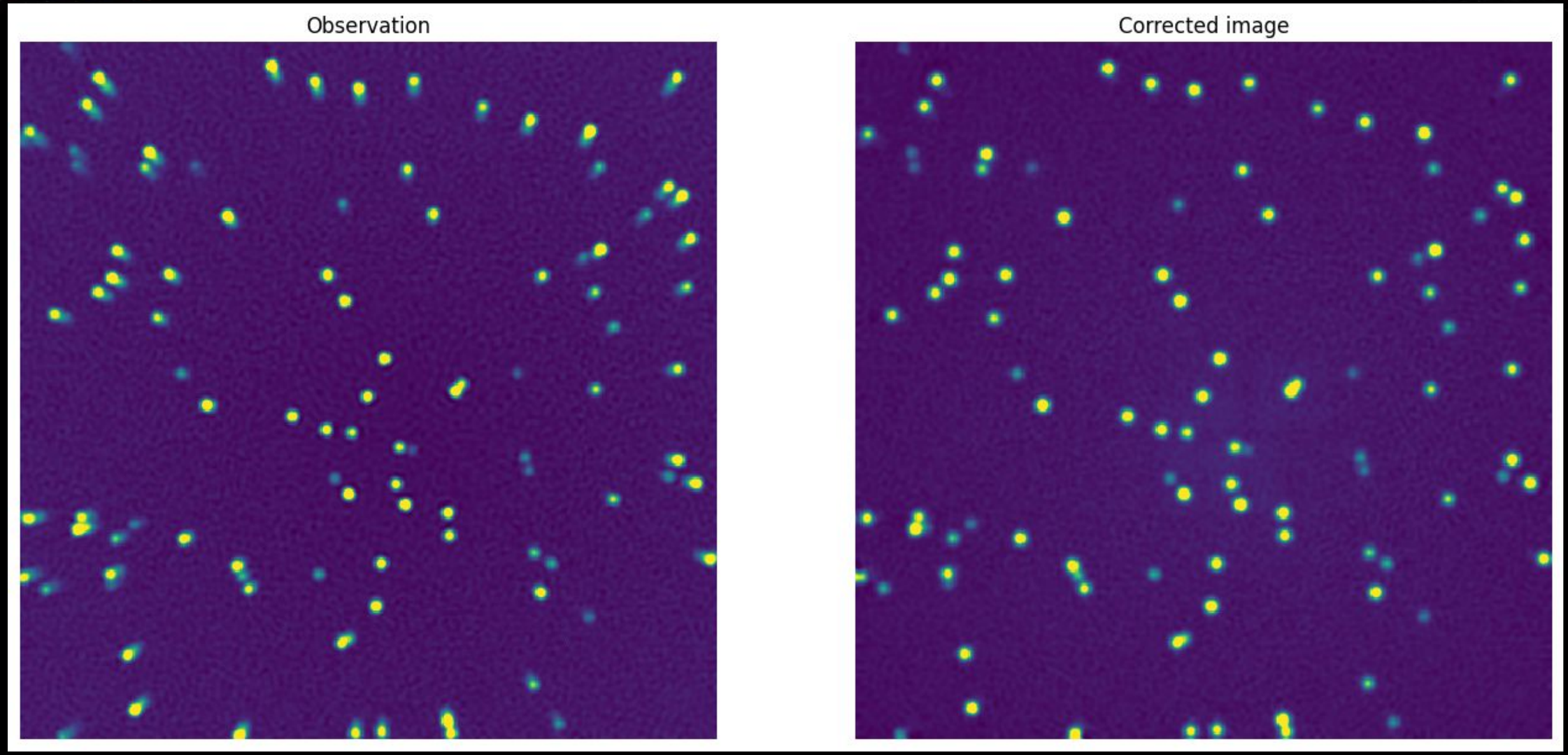
Level Q: QuickPUNCH products (much like level 2 but with a different resolution and FOV)

Level 0 → 1: Point-Spread Function Regularization



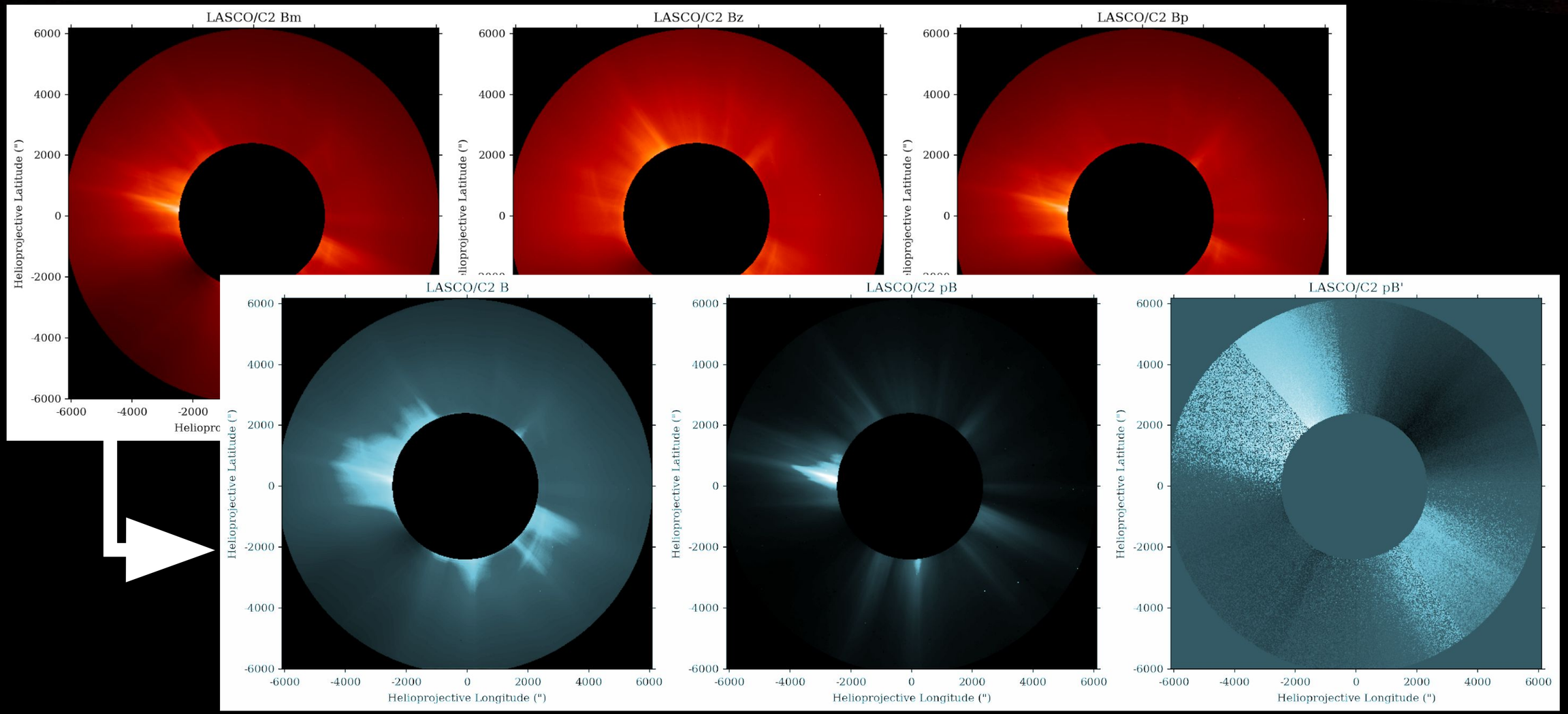
Careful treatment of the PSF is necessary
create seamless mosaics.

Level 0 → 1: Point-Spread Function Regularization



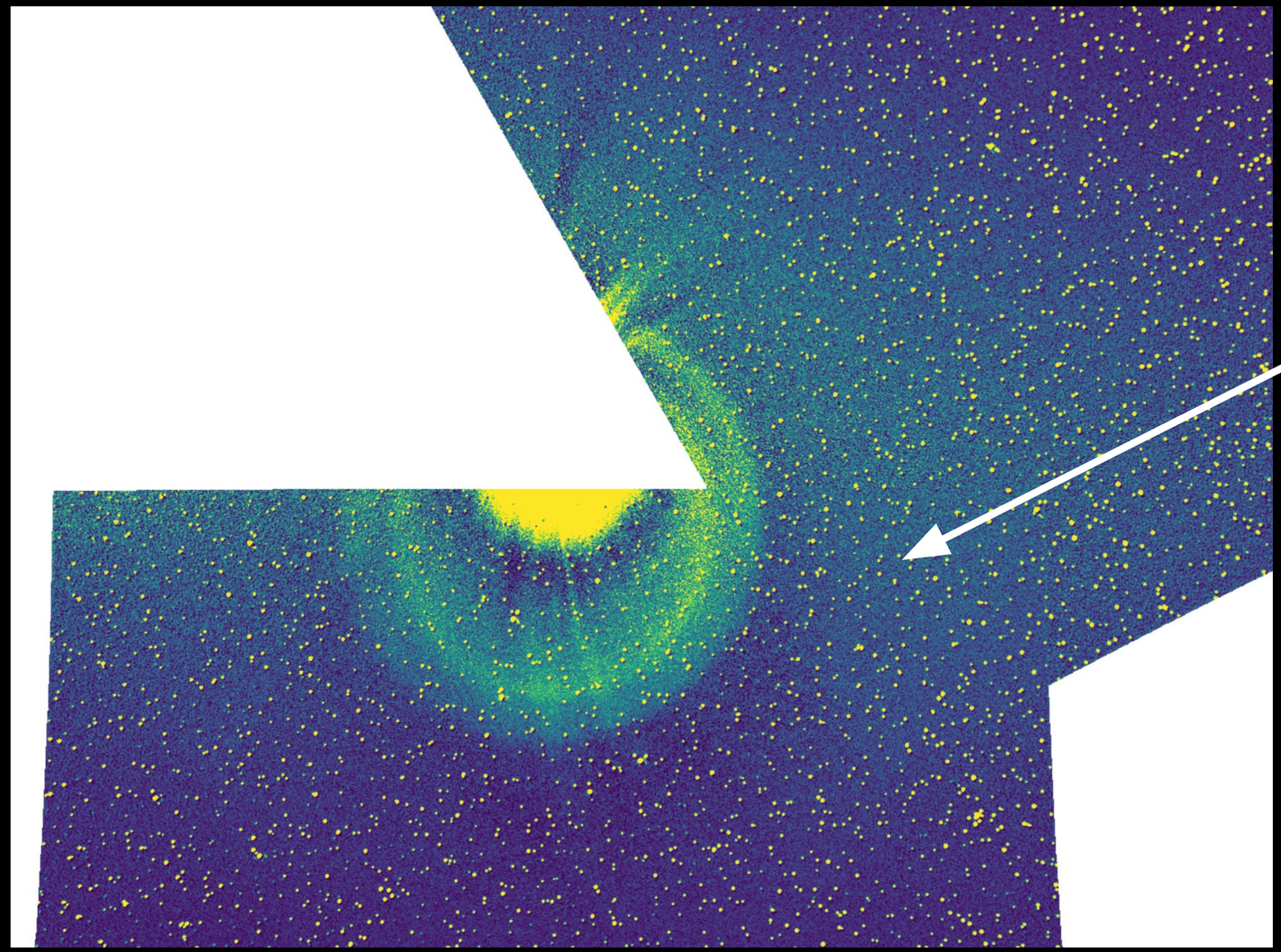
And we can do it!

Level 1→ 2: Polarization resolution via *solpolpy*



solpolpy converts from arbitrary polarization measurements to common bases.

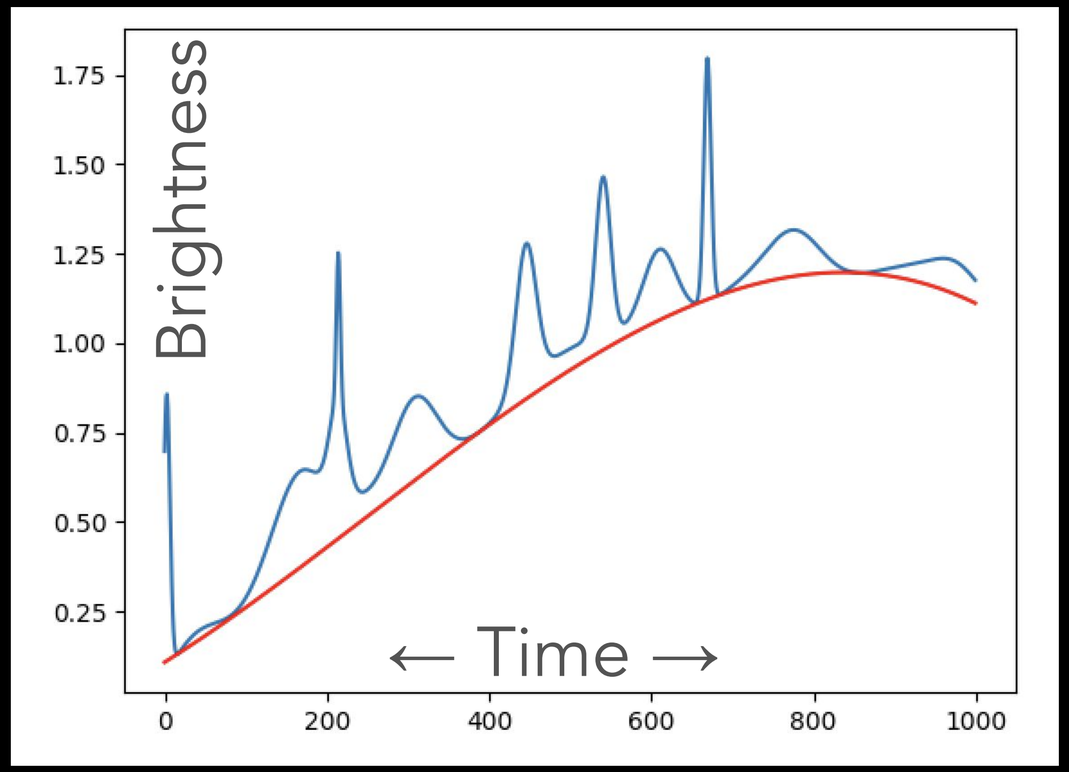
Level 1→ 2: Mosaic Building



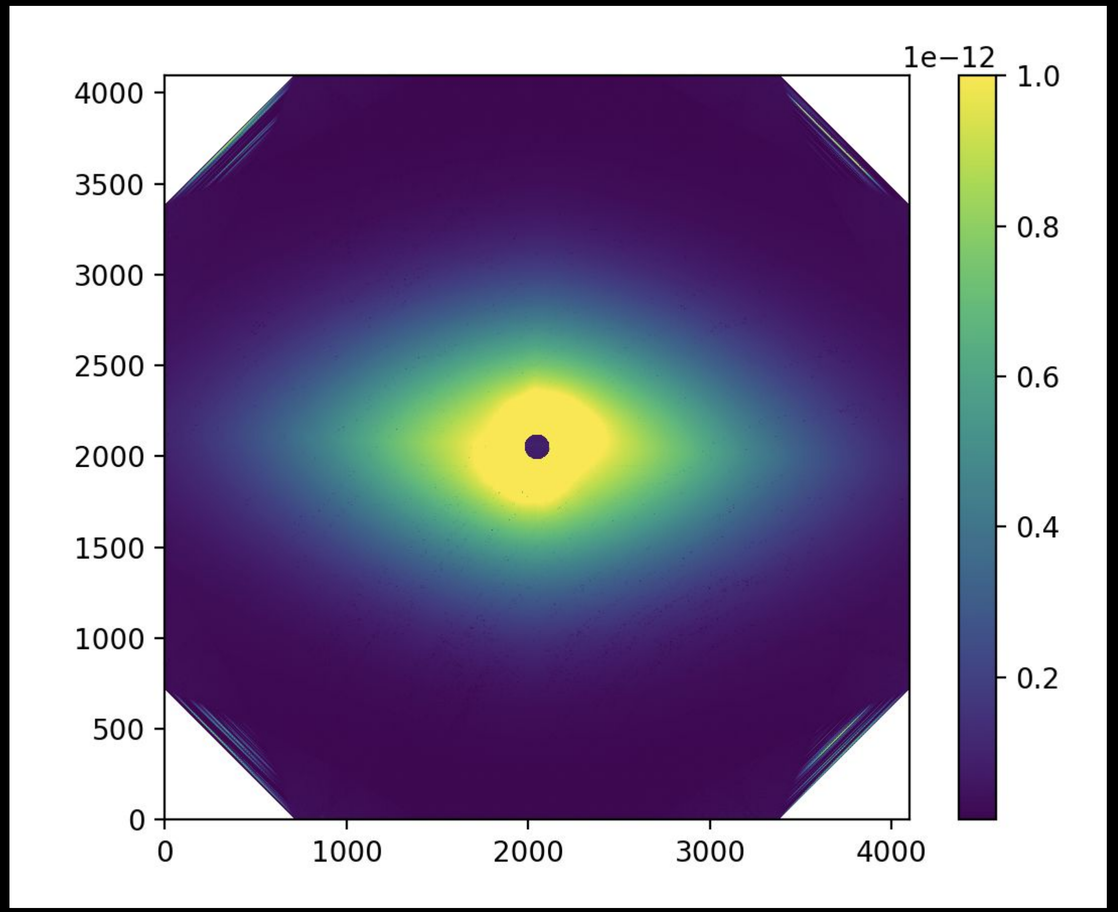
Successful Level 0 →Level 1 processing enables seamless mosaics

Level 2 → Level 3: F-corona Modeling

Blue: Pixel brightness over time
Red: Derived F-corona model

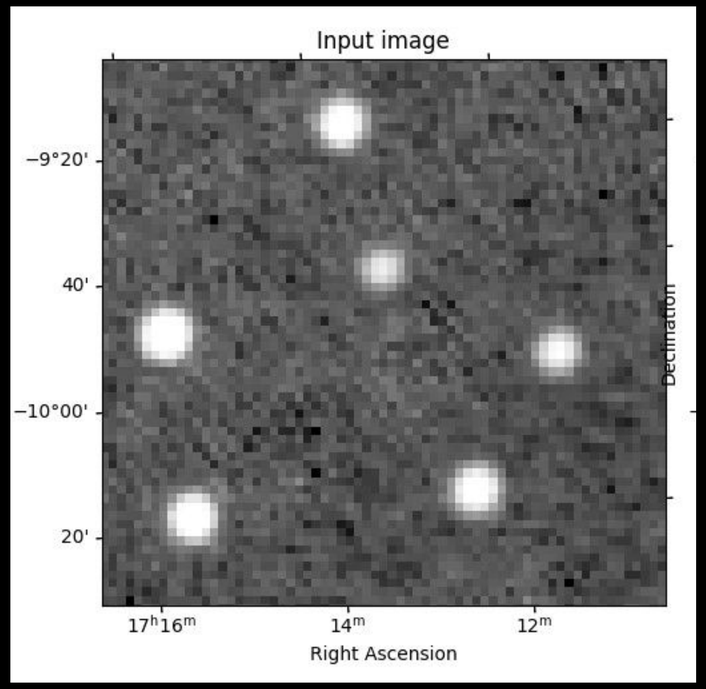


F corona model

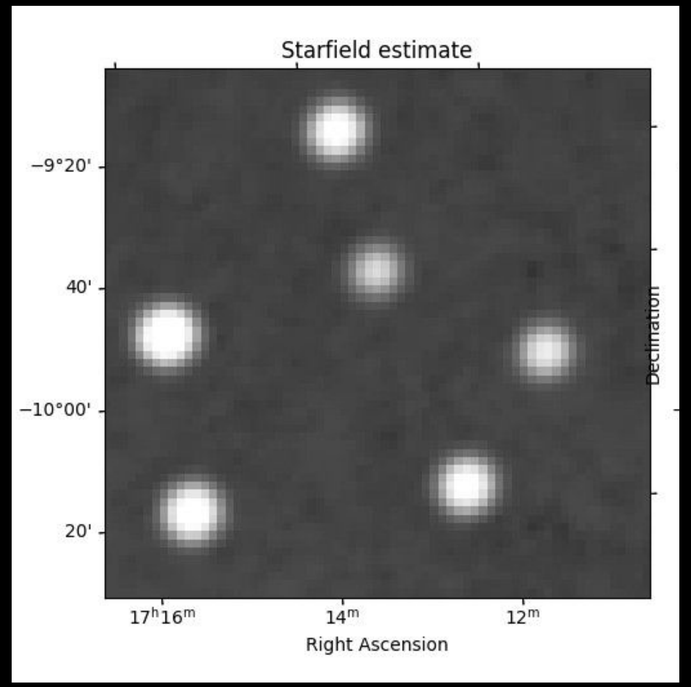


For every pixel, we fit a time-series to estimate the F-corona model at a given time.

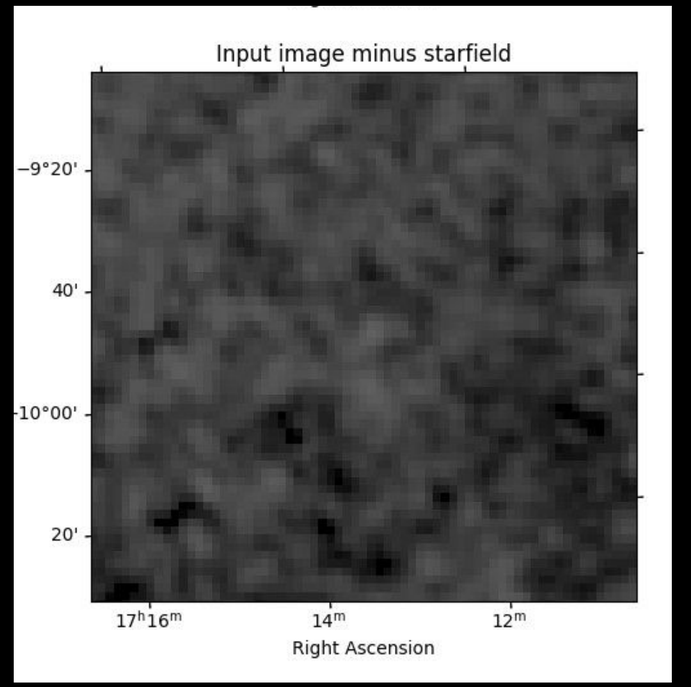
Level 2 → Level 3 Starfield Subtraction



Level 2(ish) Image



Starfield Model



Level 3 Image

We routinely build starfield models from PUNCH observations.
Stay tuned to hear from Sam Van Kooten.

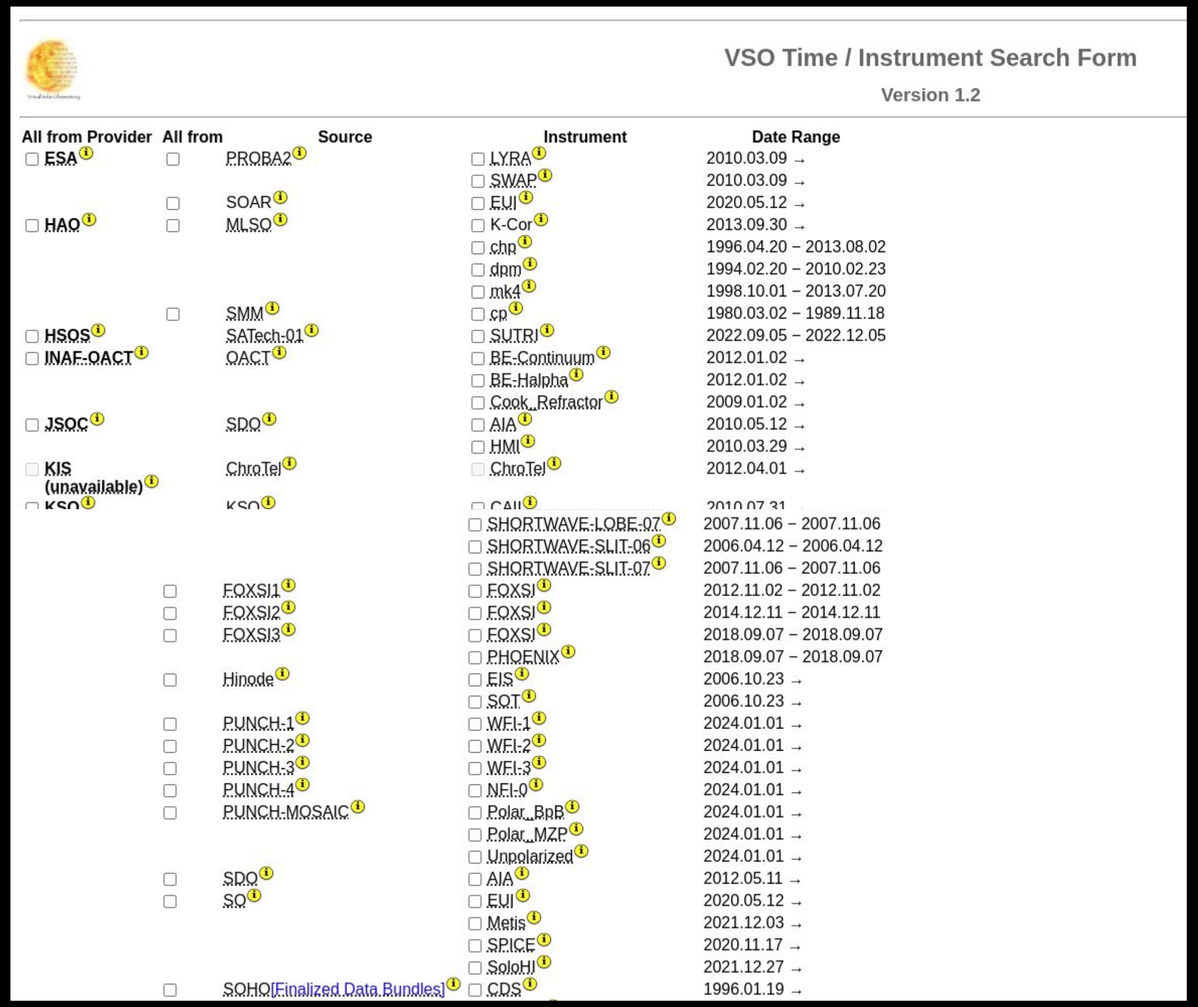
How to get data

Data will be available through the SDAC without any embargo.

Level 0 and 1 products are available the fastest.

Level 2 wait until all satellites have responded.

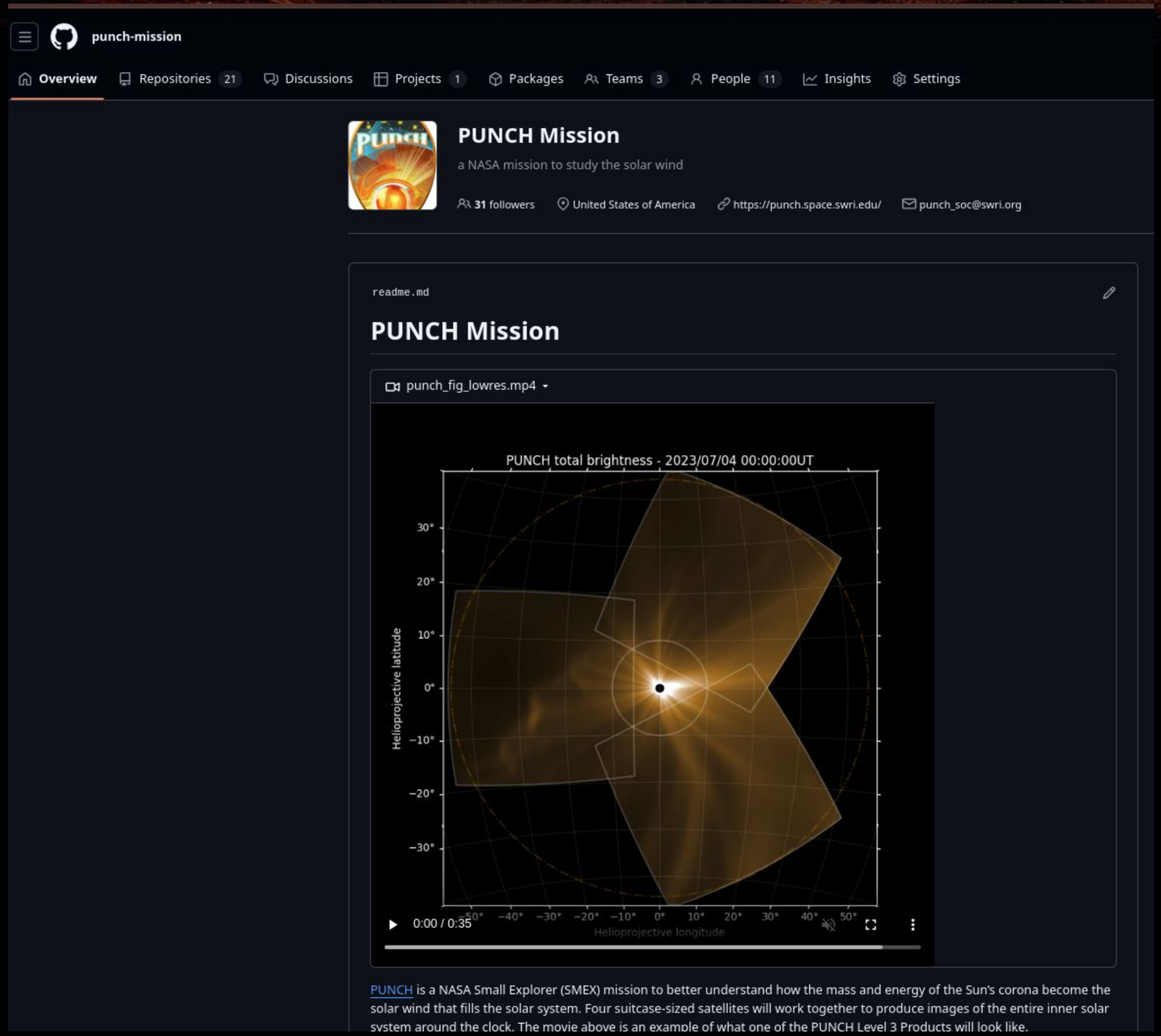
Level 3 require building the F-corona and starfield models and thus take a couple weeks.



Join Us!

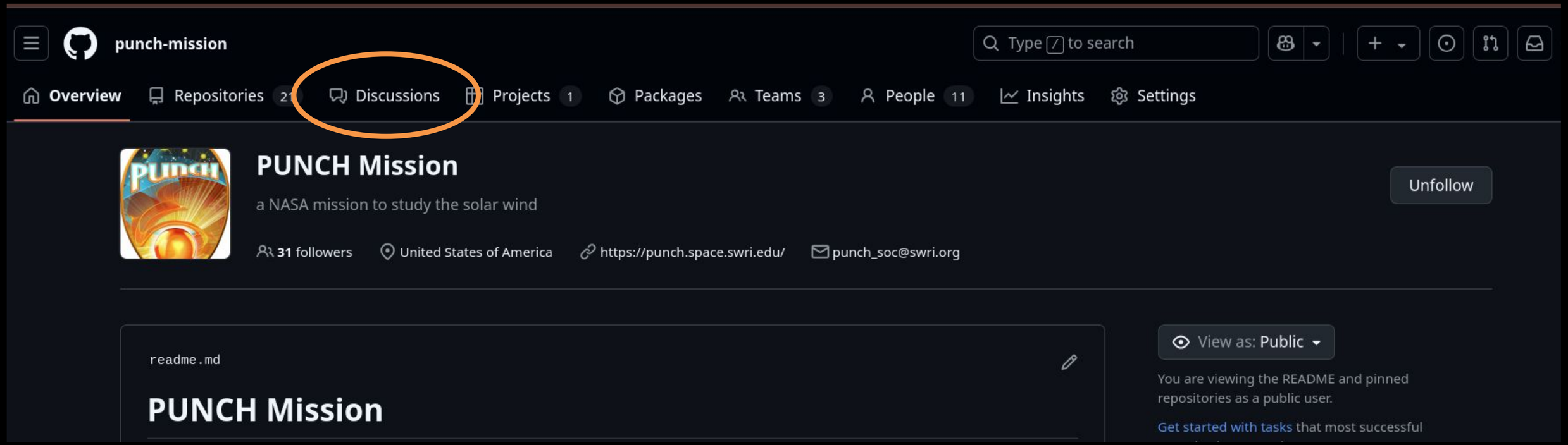
https://github.com/punch-mission

SCAN ME



Have a Discussion

https://github.com/punch-mission



Each repository has a discussion (and issues) tab.

Feel free to open a discussion anywhere.

We'll respond.

Summary

- Data will be available through the Virtual Solar Observatory via the Solar Data Analysis Center
  - Retrieve with SunPy's search interface
  - Data will also be available in NASA HelioCloud

Related presentations:

- Chris Lowder: PUNCH Data–A Guided Tour
- Sam Van Kooten: Photometric starfield subtraction from PUNCH images
- Raphael Attie: Tracking Solar Wind Evolution with PUNCH Flow Maps

Polarimeter to Unify the Corona and Heliosphere

SCAN ME

We want to work with you!

github.com/punch-mission

punch_soc@swri.org