

SunPy: Status of the Project and v2.0 Core Package

Monica Bobra on behalf of The SunPy Community
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⌚ mbobra

Why do we need SunPy?

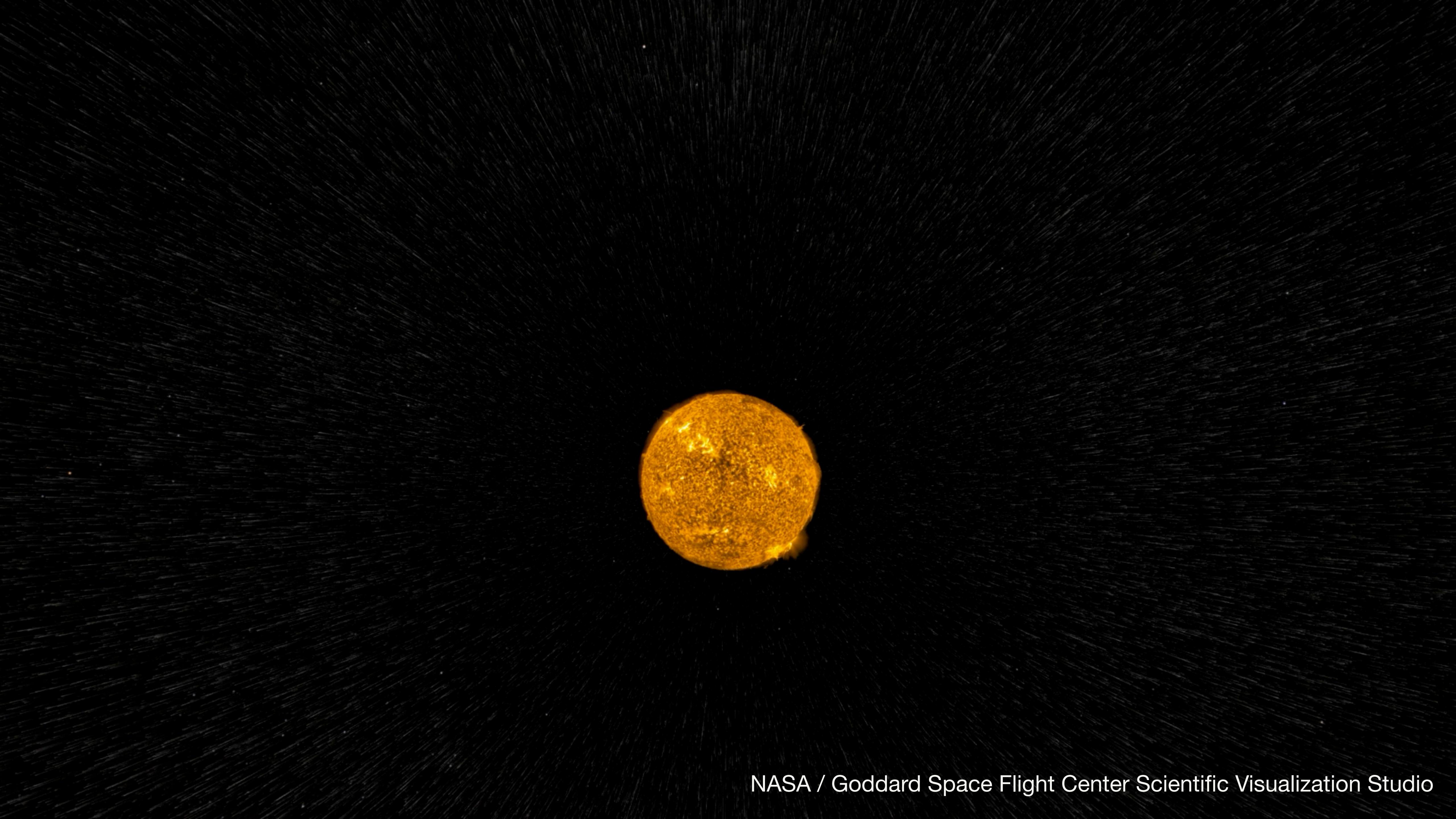
What's in SunPy v2.0?

How did we (hopefully) gain visibility?

Why do we need SunPy?

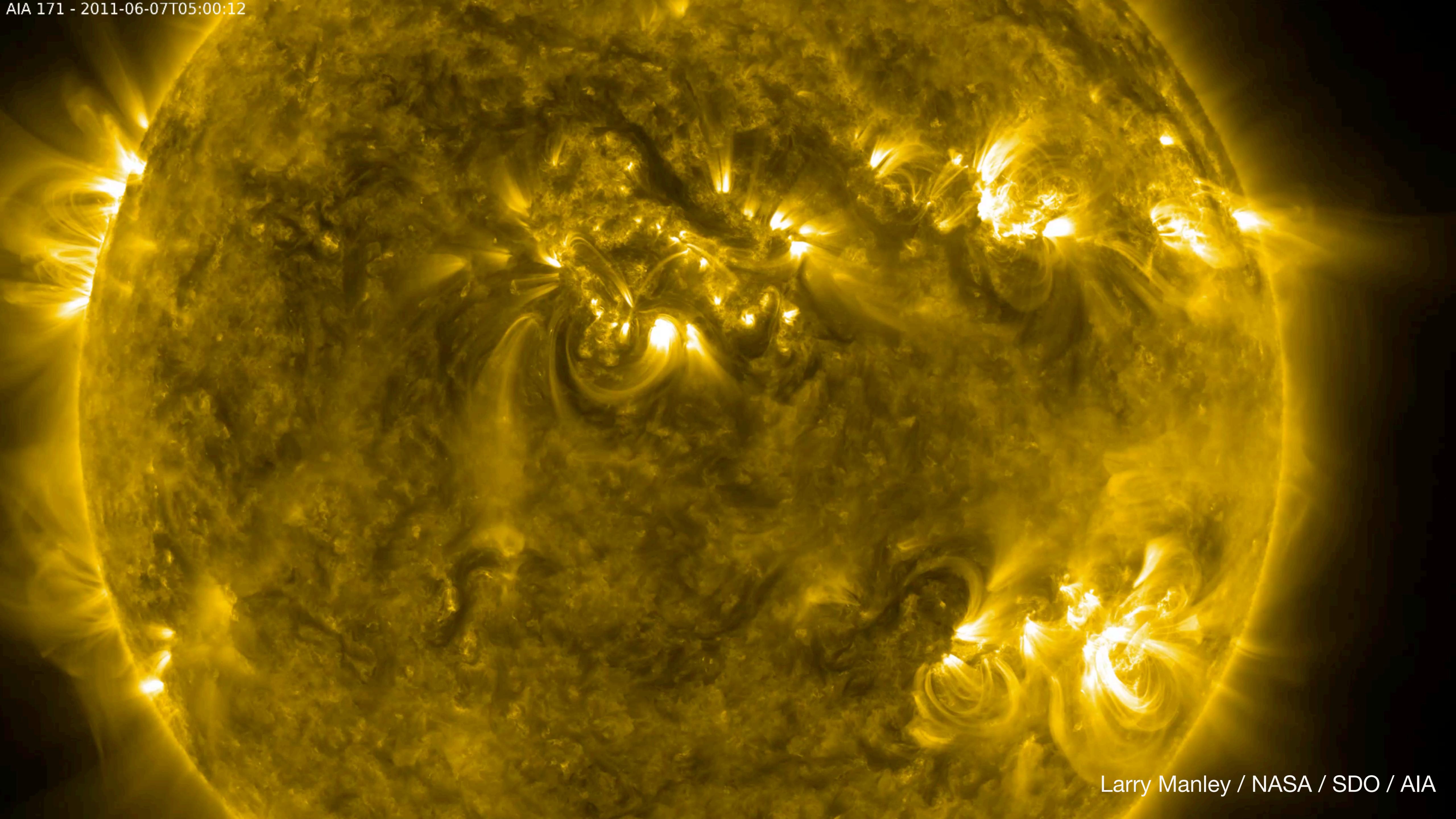
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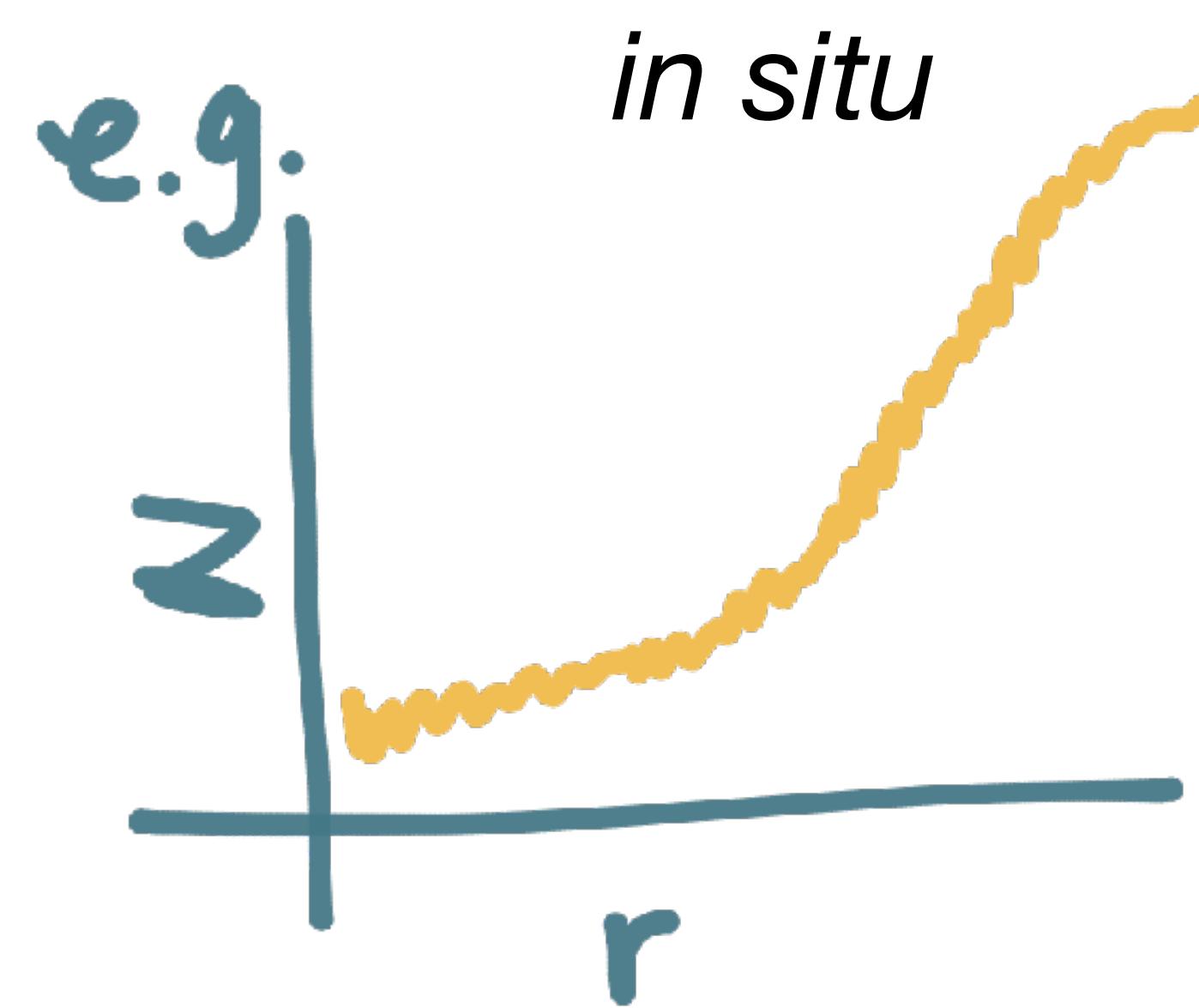
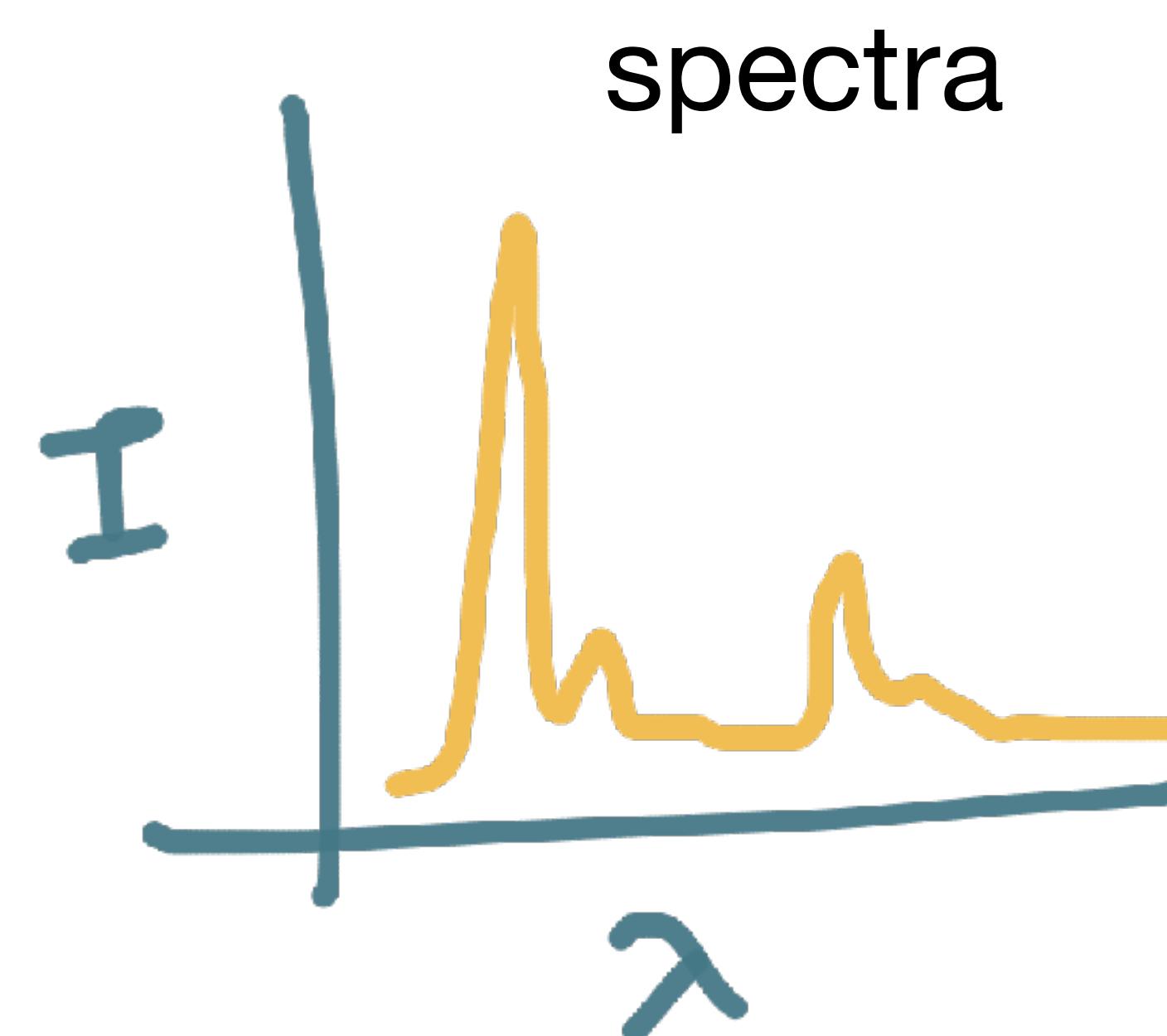
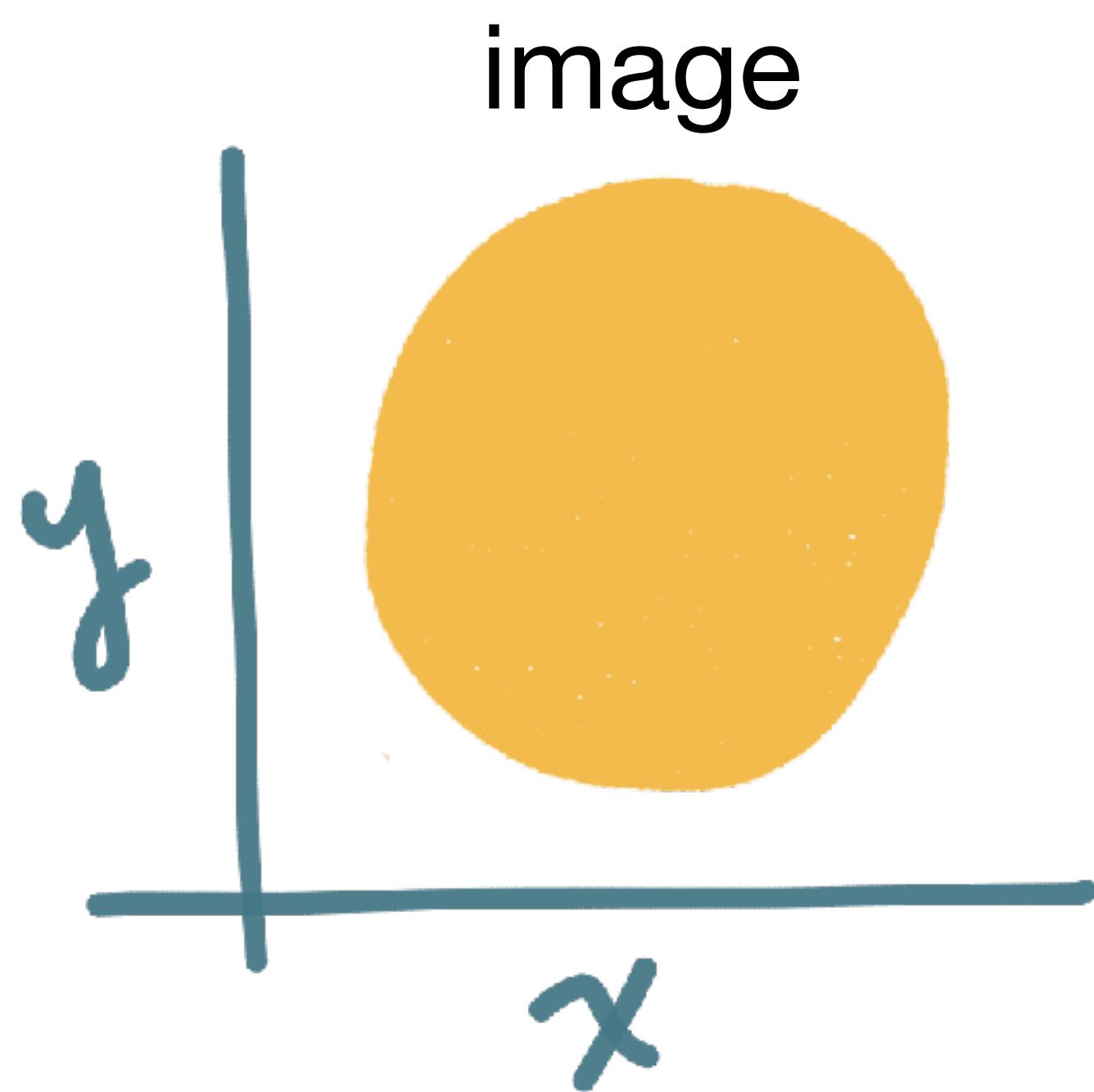


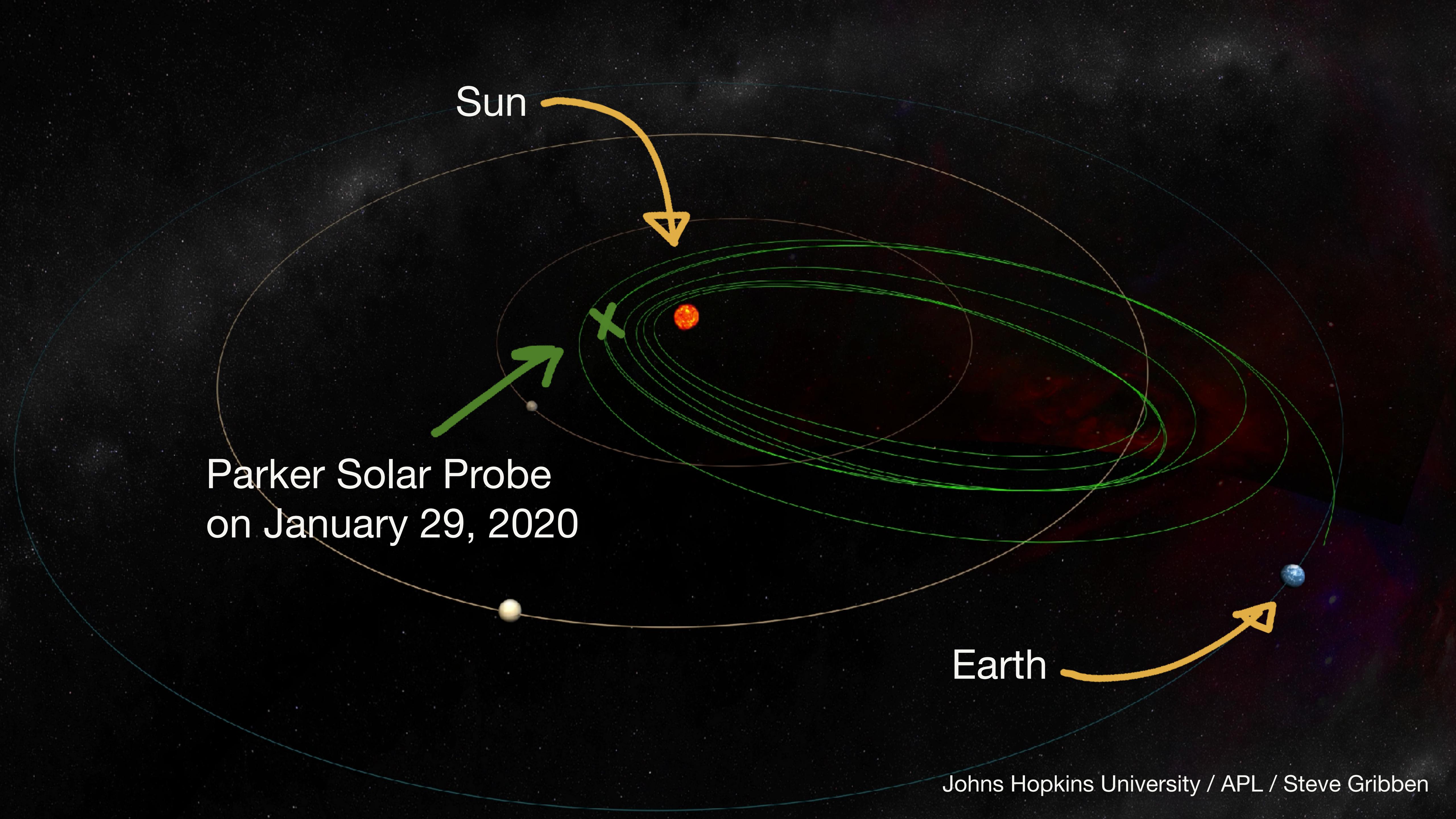
NASA / Goddard Space Flight Center Scientific Visualization Studio

AIA 171 - 2011-06-07T05:00:12



Larry Manley / NASA / SDO / AIA

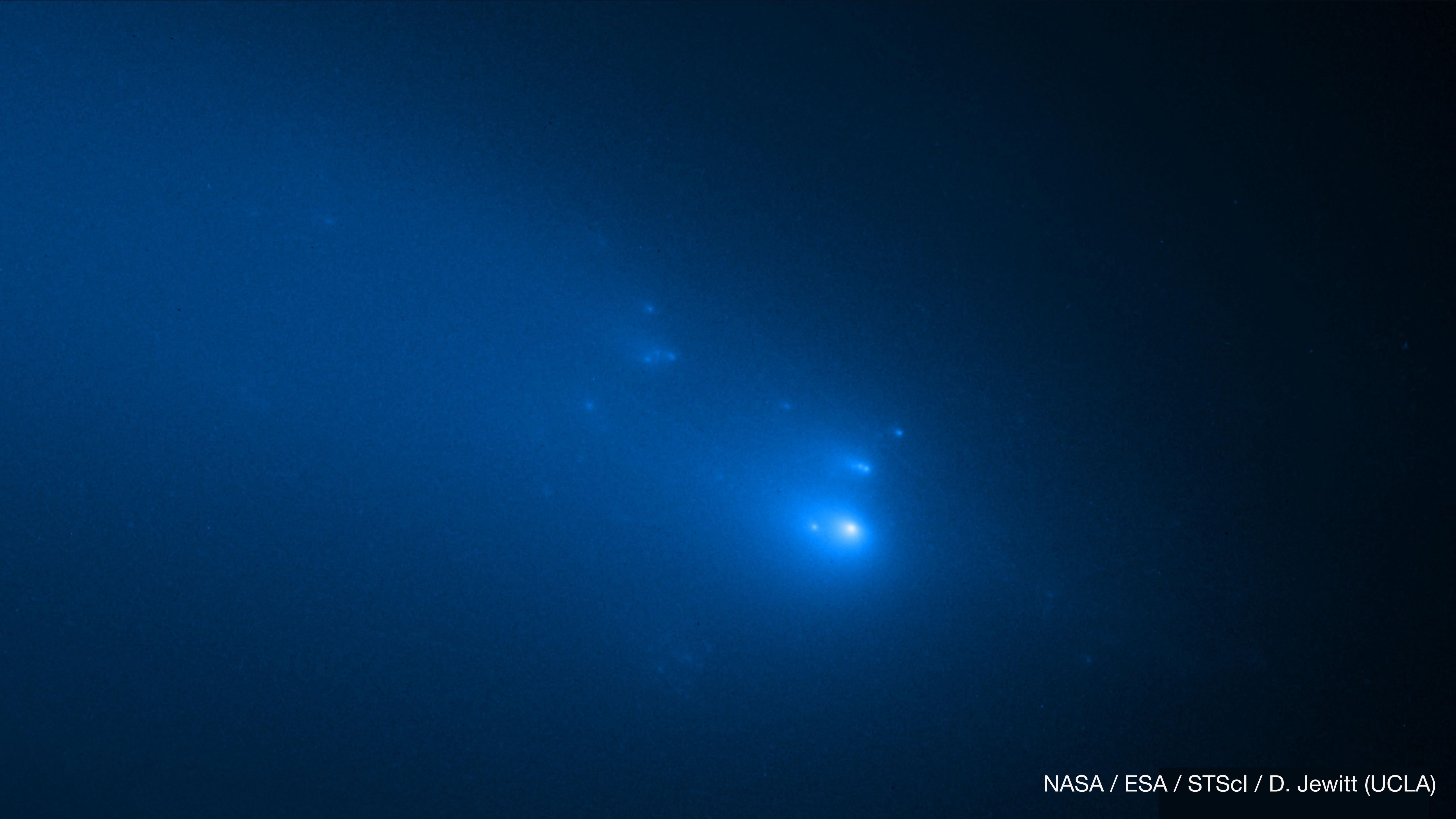




Parker Solar Probe
on January 29, 2020

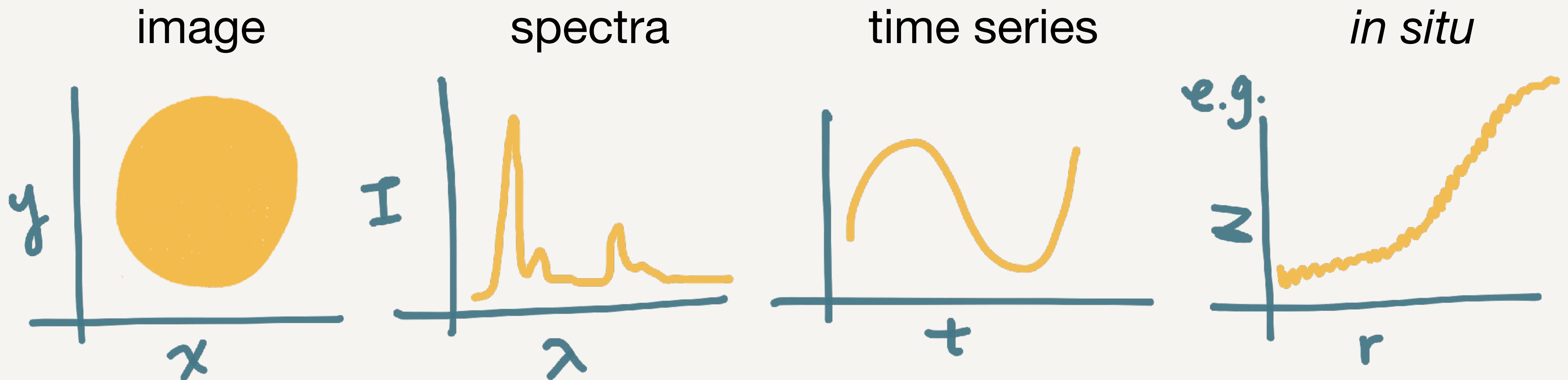
Sun

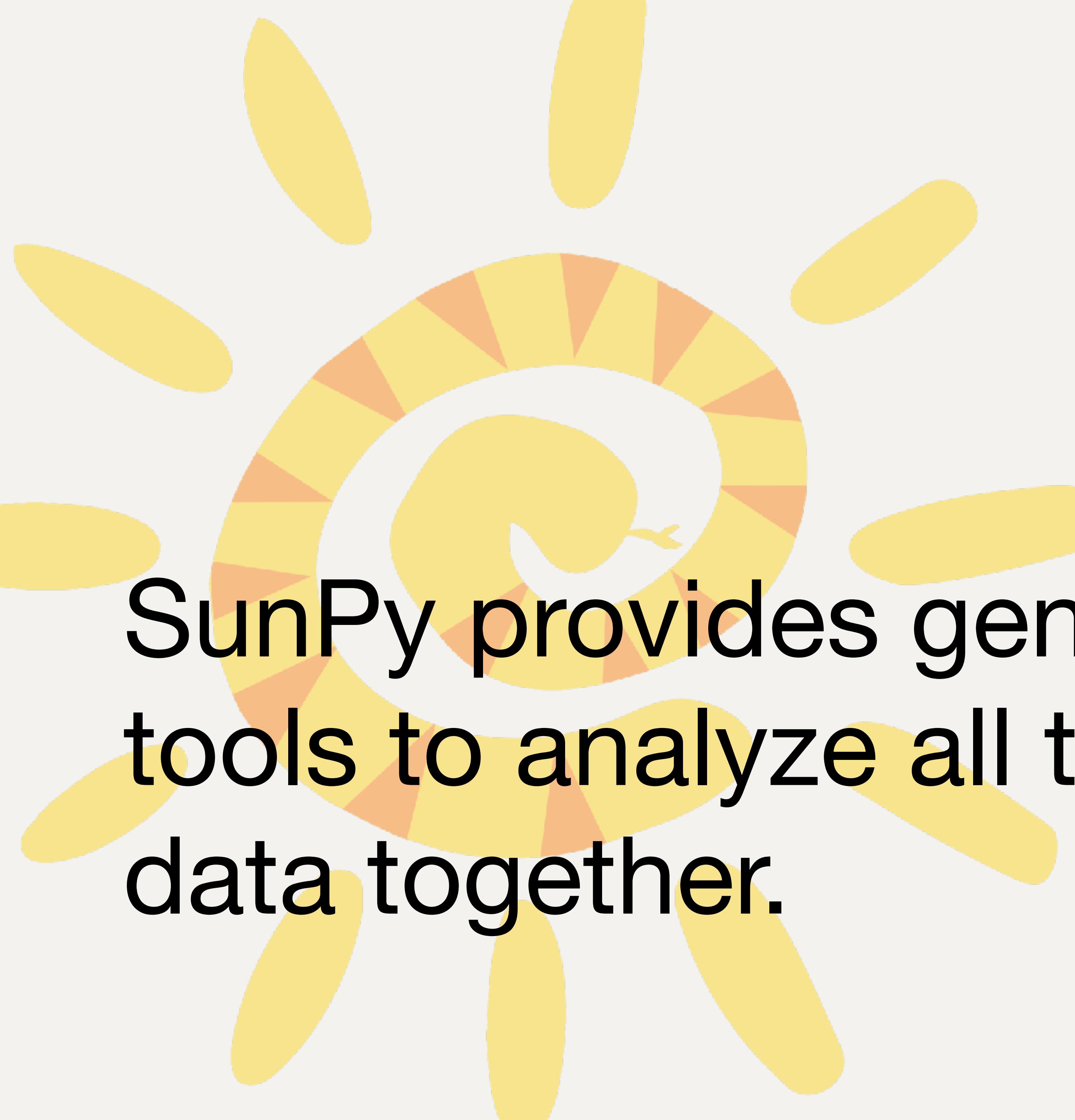
Earth



NASA / ESA / STScI / D. Jewitt (UCLA)

NASA: 6 space-based solar missions
NSF: 10 ground-based facilities



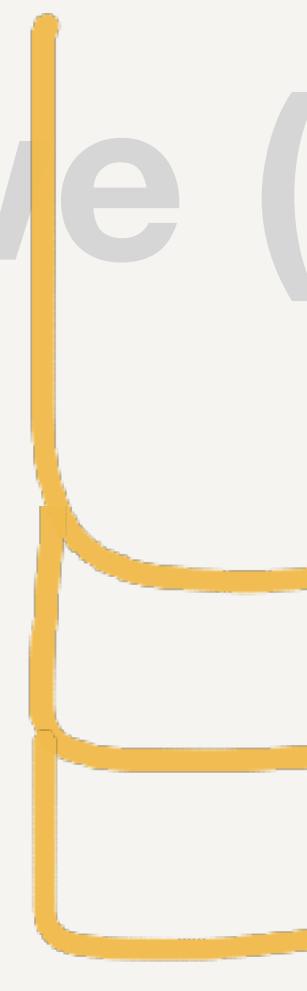


**SunPy provides general-purpose
tools to analyze all these disparate
data together.**

Why do we need SunPy?

What's in SunPy v2.0?

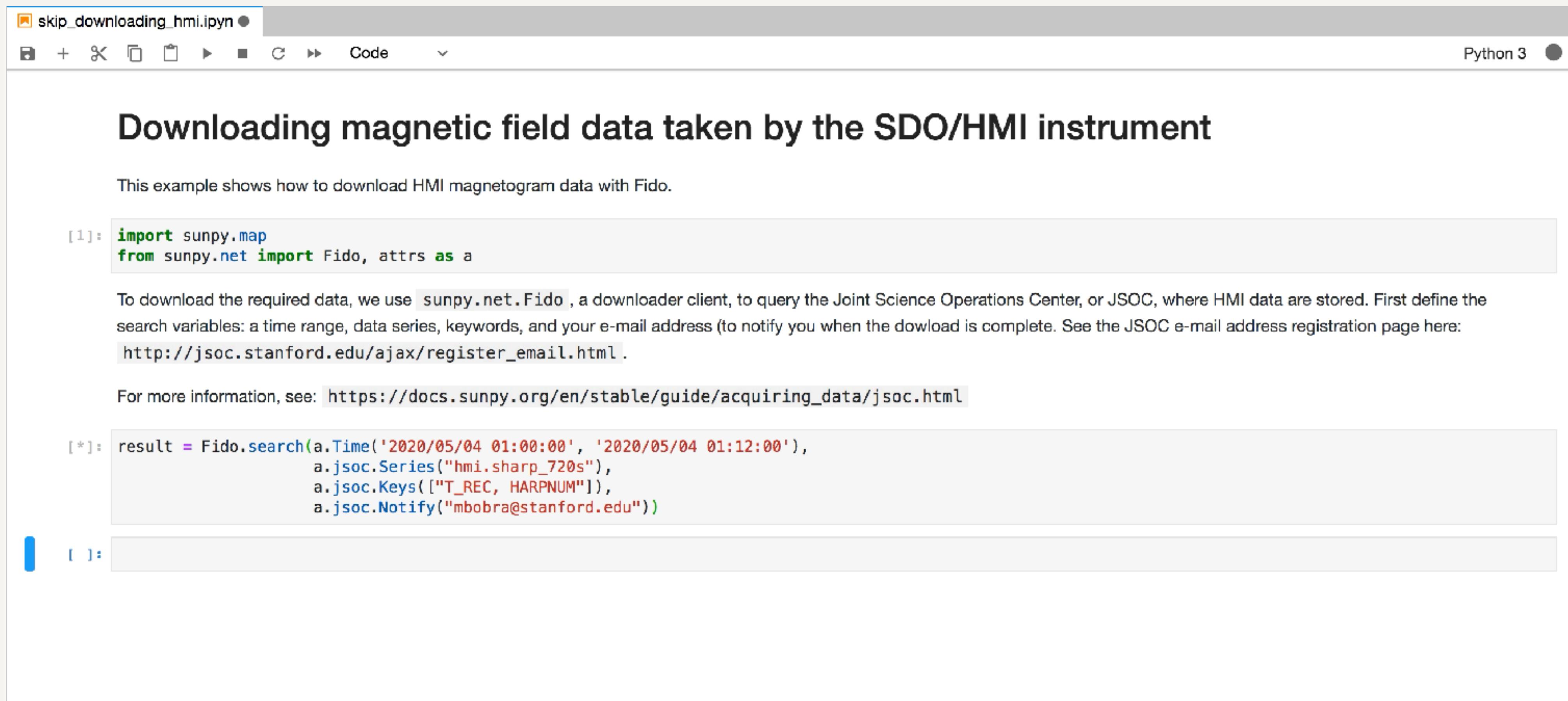
How did we (hopefully) gain visibility?



- Data retriever
- Data containers
- Coordinate systems

Data Retriever: Fido

A Jupyter Notebook example implementation for retrieving data



The screenshot shows a Jupyter Notebook interface with the following details:

- Title Bar:** The title bar displays the file name "skip_downloading_hmi.ipynb".
- Toolbar:** Standard Jupyter Notebook toolbar icons are visible.
- Code Cell:** A code cell titled "[1]:" contains the following Python code:

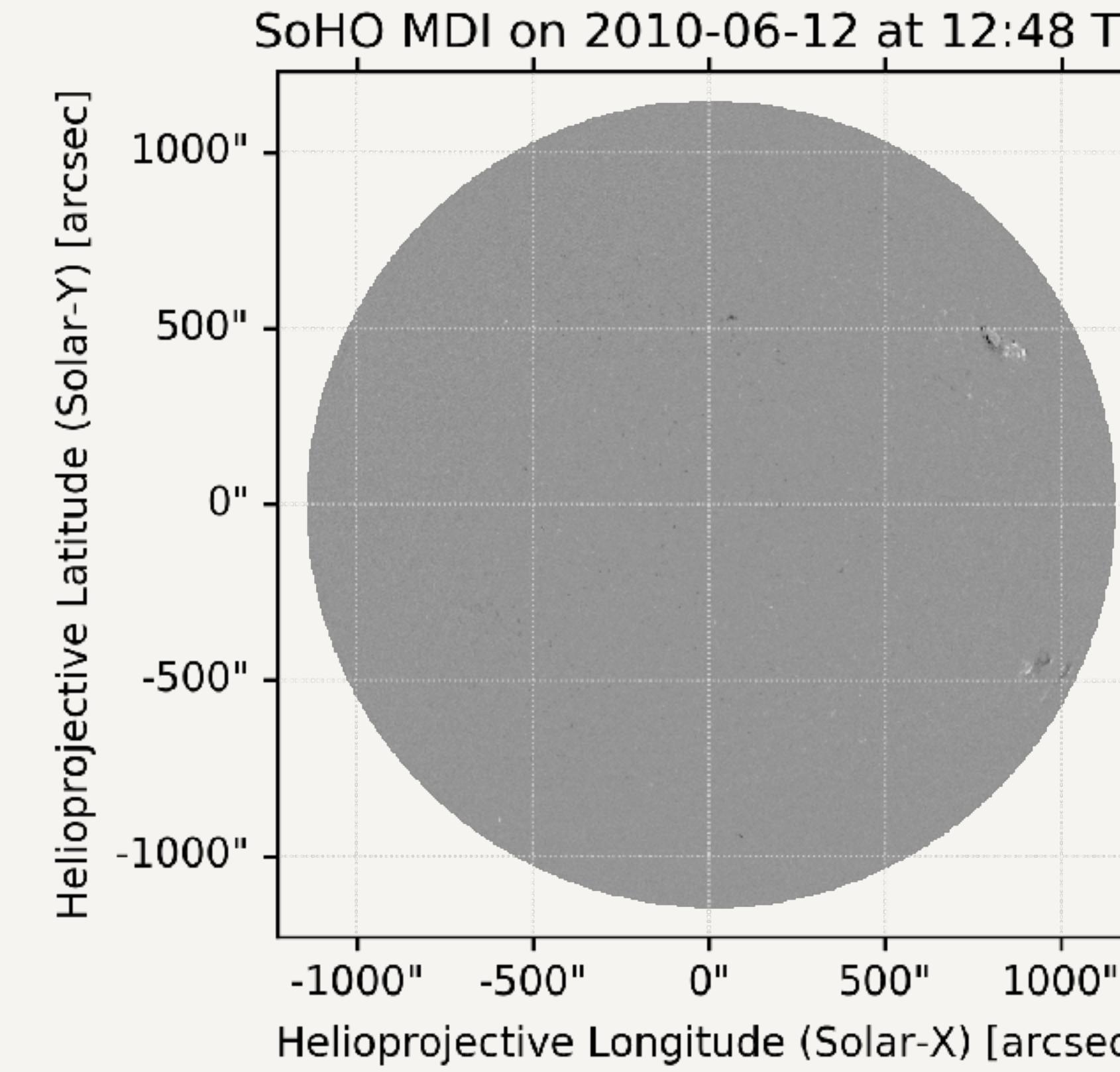
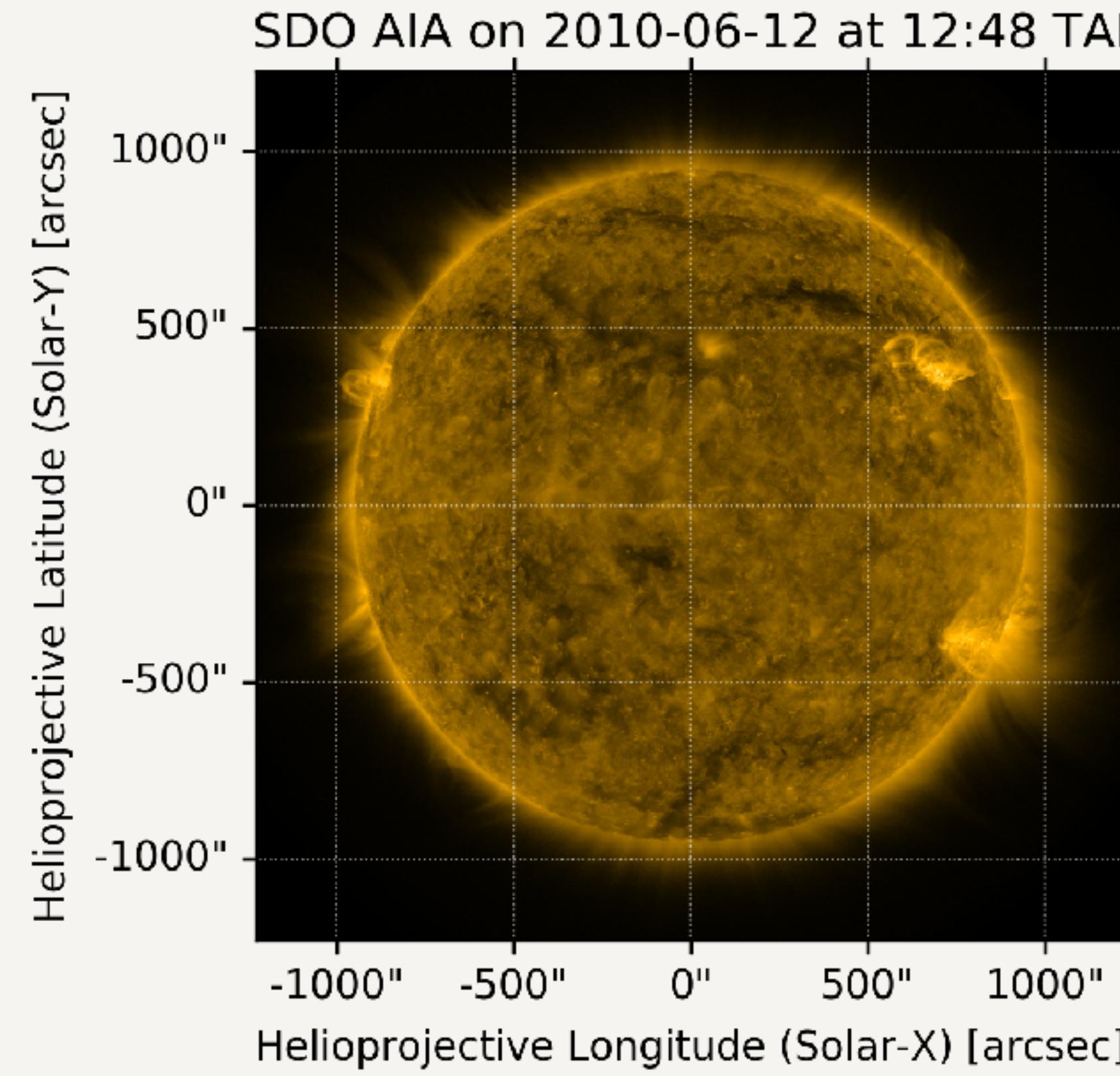
```
import sunpy.map
from sunpy.net import Fido, attrs as a
```
- Text Cell:** A text cell titled "[*]:" provides instructions on how to download HMI data using the Fido client. It states: "To download the required data, we use `sunpy.net.Fido`, a downloader client, to query the Joint Science Operations Center, or JSOC, where HMI data are stored. First define the search variables: a time range, data series, keywords, and your e-mail address (to notify you when the dowload is complete. See the JSOC e-mail address registration page here: http://jsoc.stanford.edu/ajax/register_email.html. For more information, see: https://docs.sunpy.org/en/stable/guide/acquiring_data/jsoc.html
- Output Cell:** An output cell titled "[]:" shows the result of the search command, which is a list of URLs for the downloaded data files.

Data Containers

A general, standard, and consistent interface for analyzing data

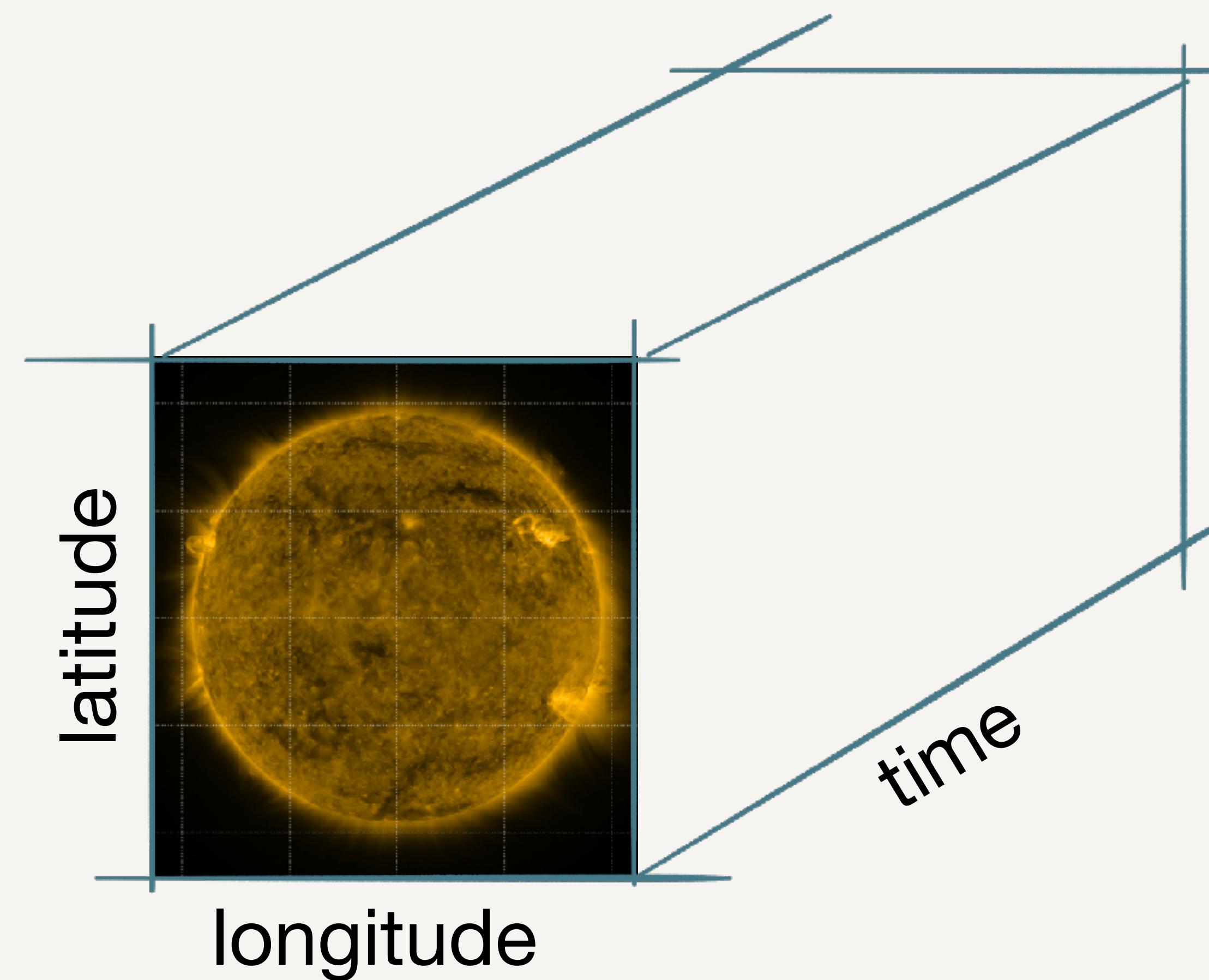
Data Containers

v2.0: Map object includes new methods to produce graphical overviews



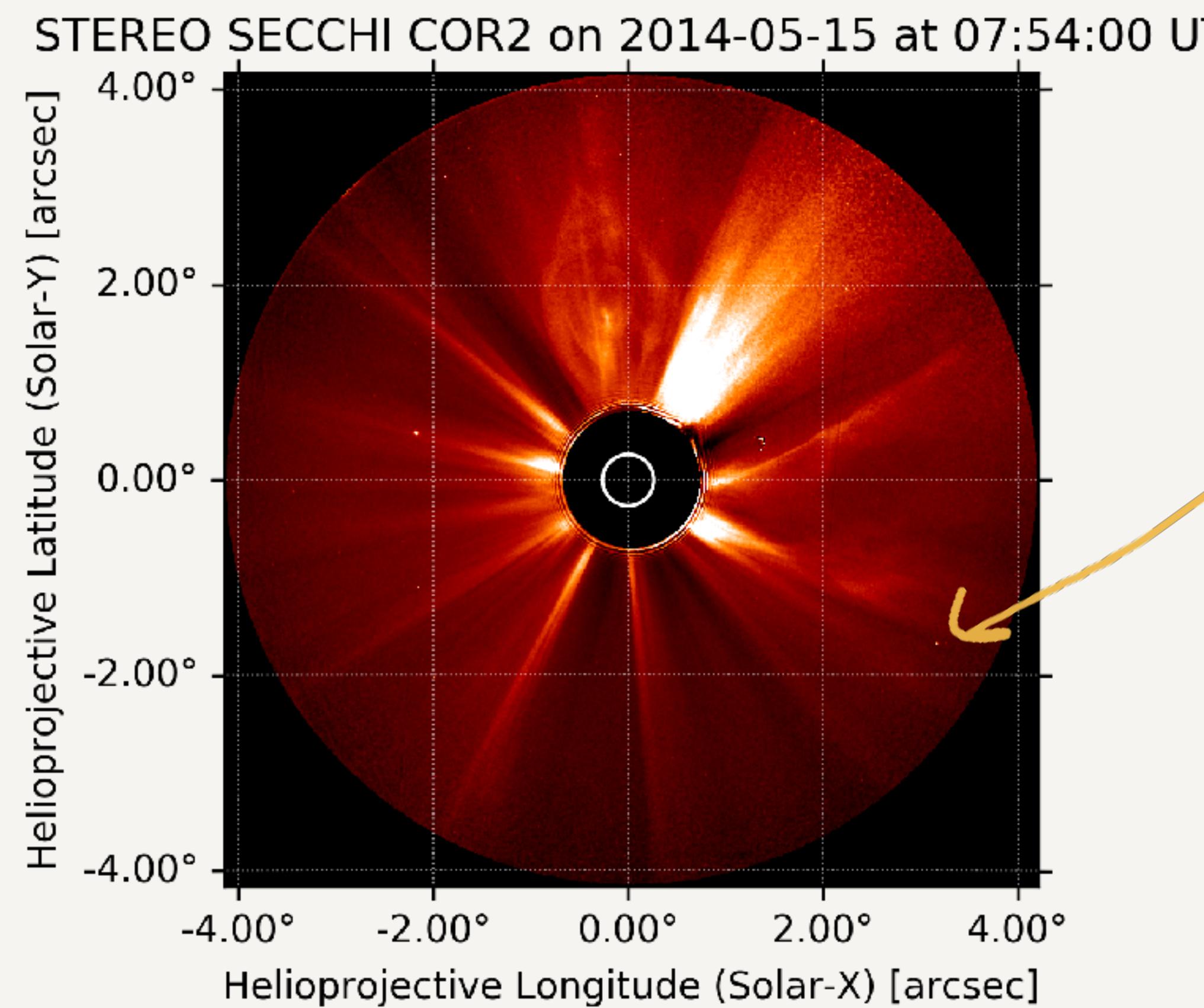
Data Containers

v3.0 planned upgrade to N-dimensional coordinate-aware Map object



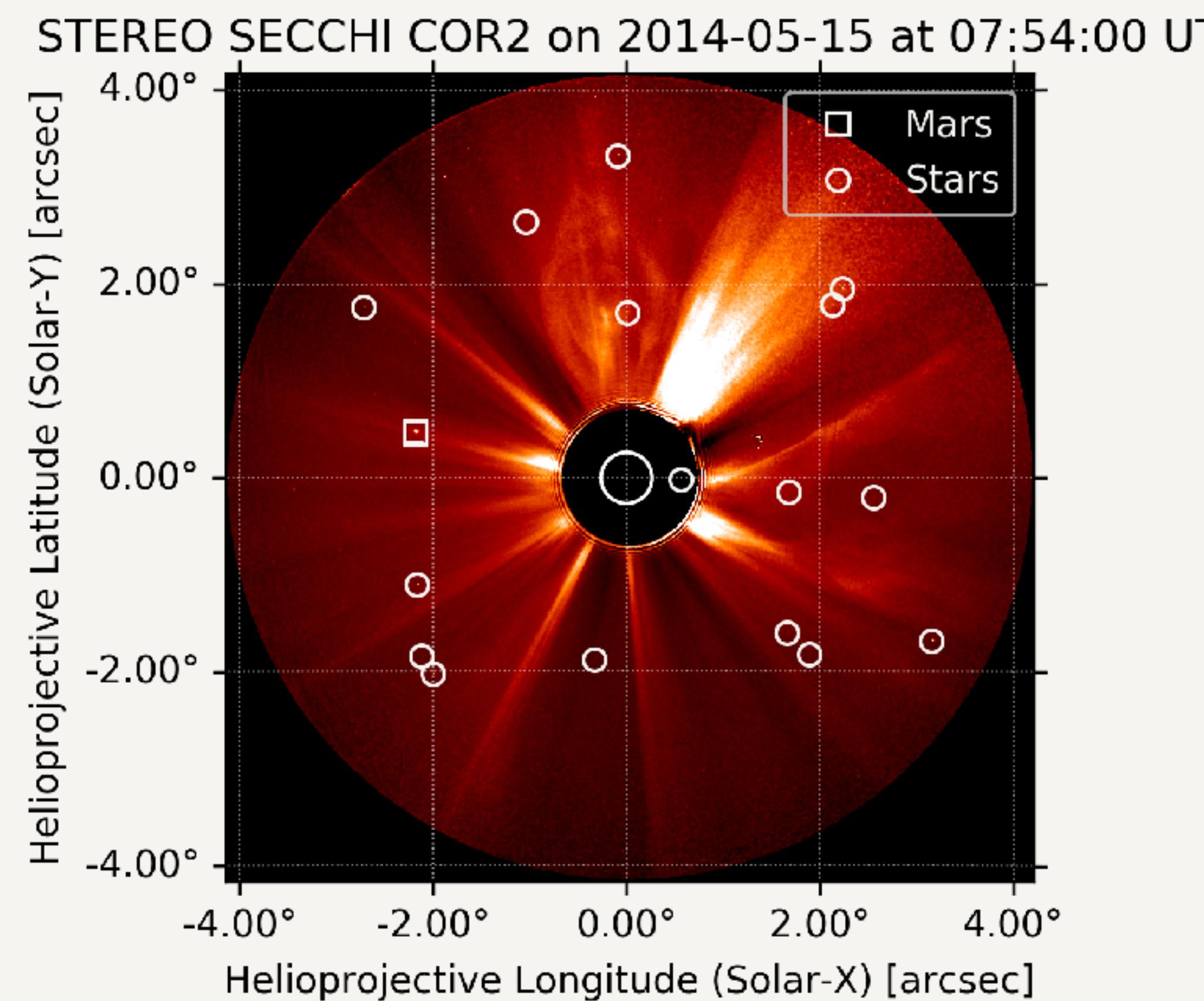
Coordinate systems

A way to transform data between many coordinate systems



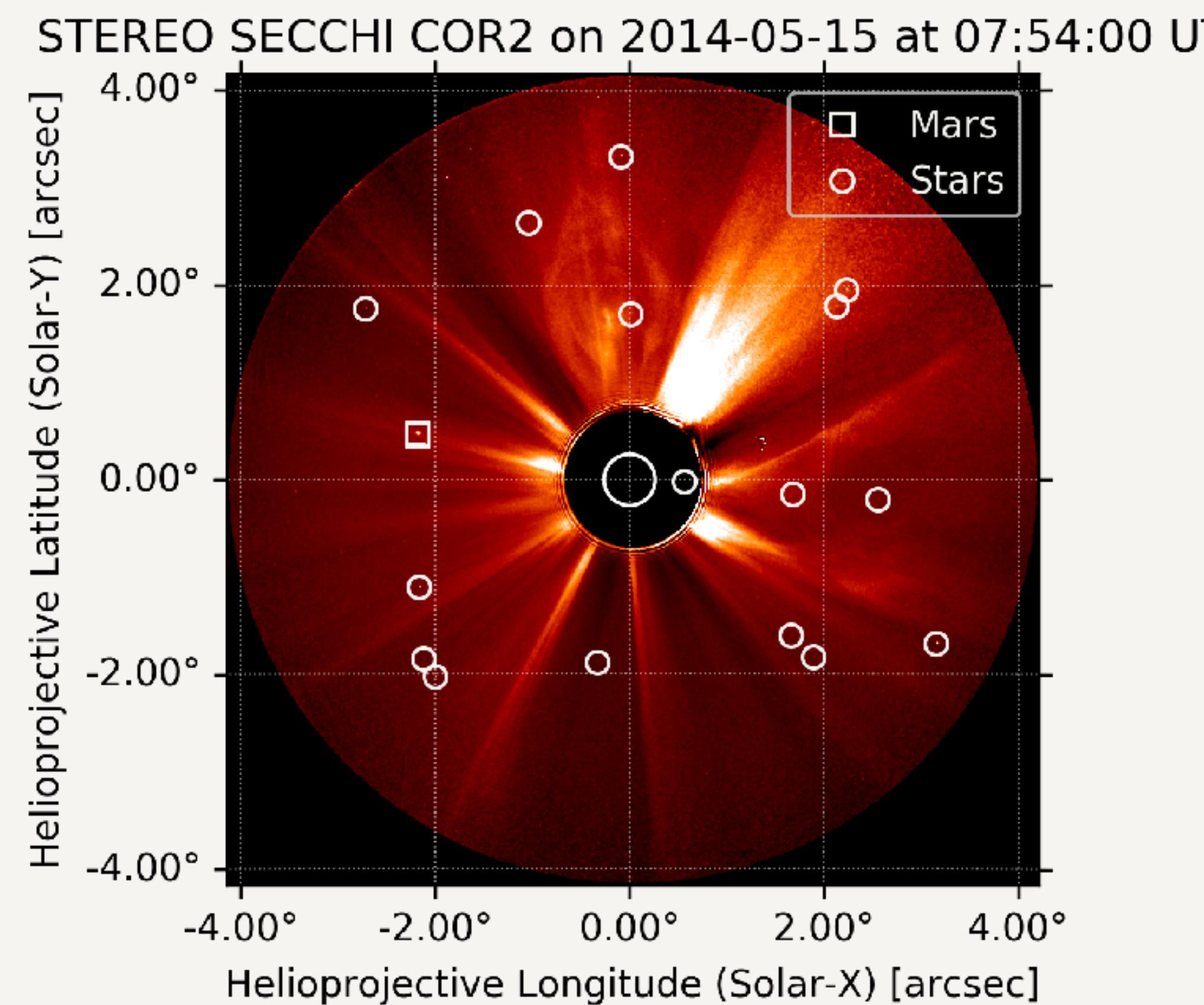
Coordinate systems

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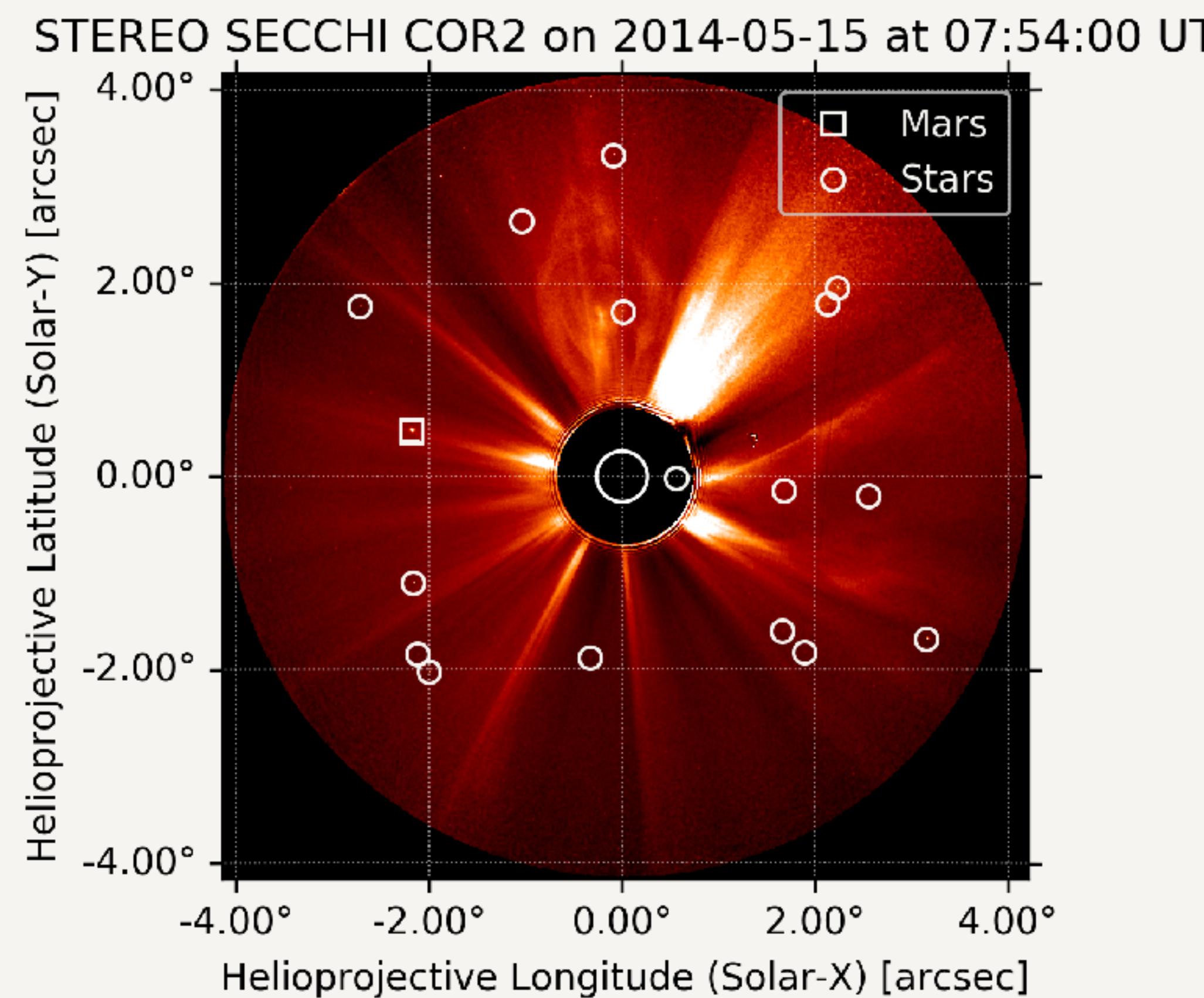
Coordinate systems

v1.0: Improved precision of transformations + tooling for small bodies



Coordinate systems

v2.0: Improved our treatment of differential rotation



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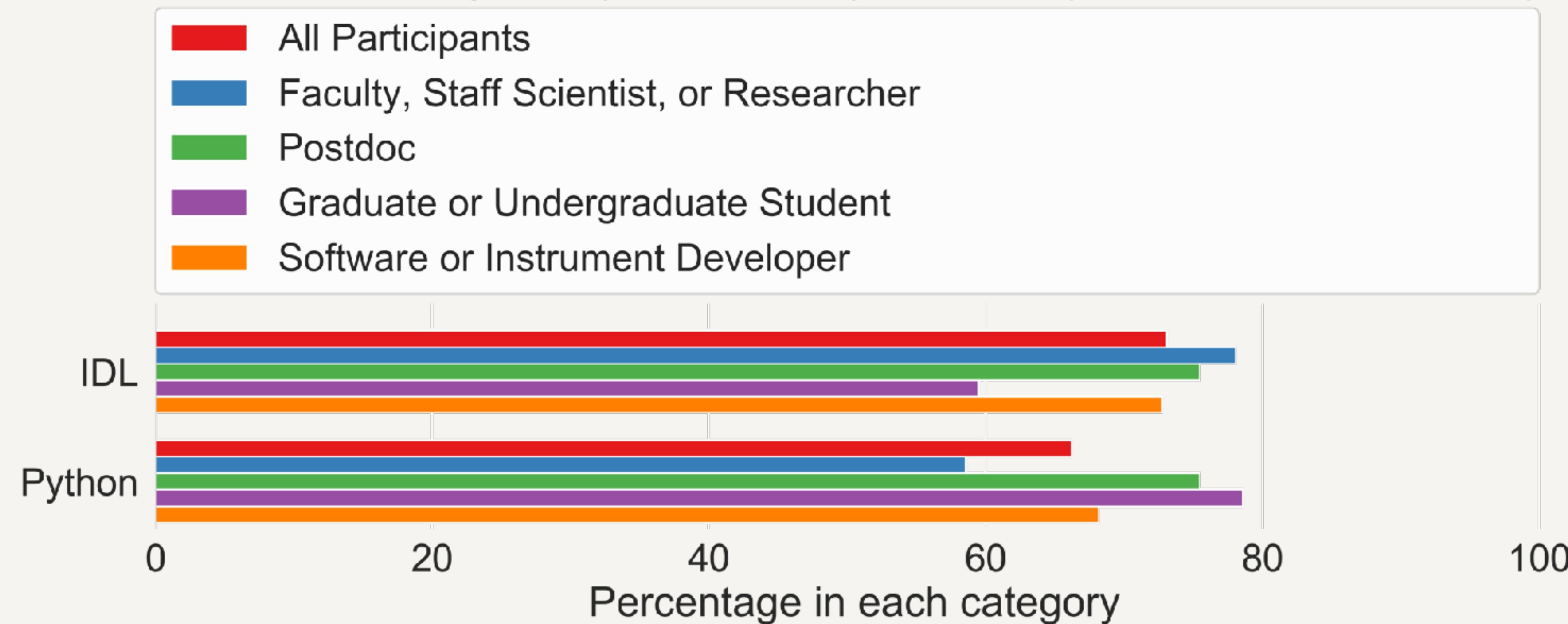
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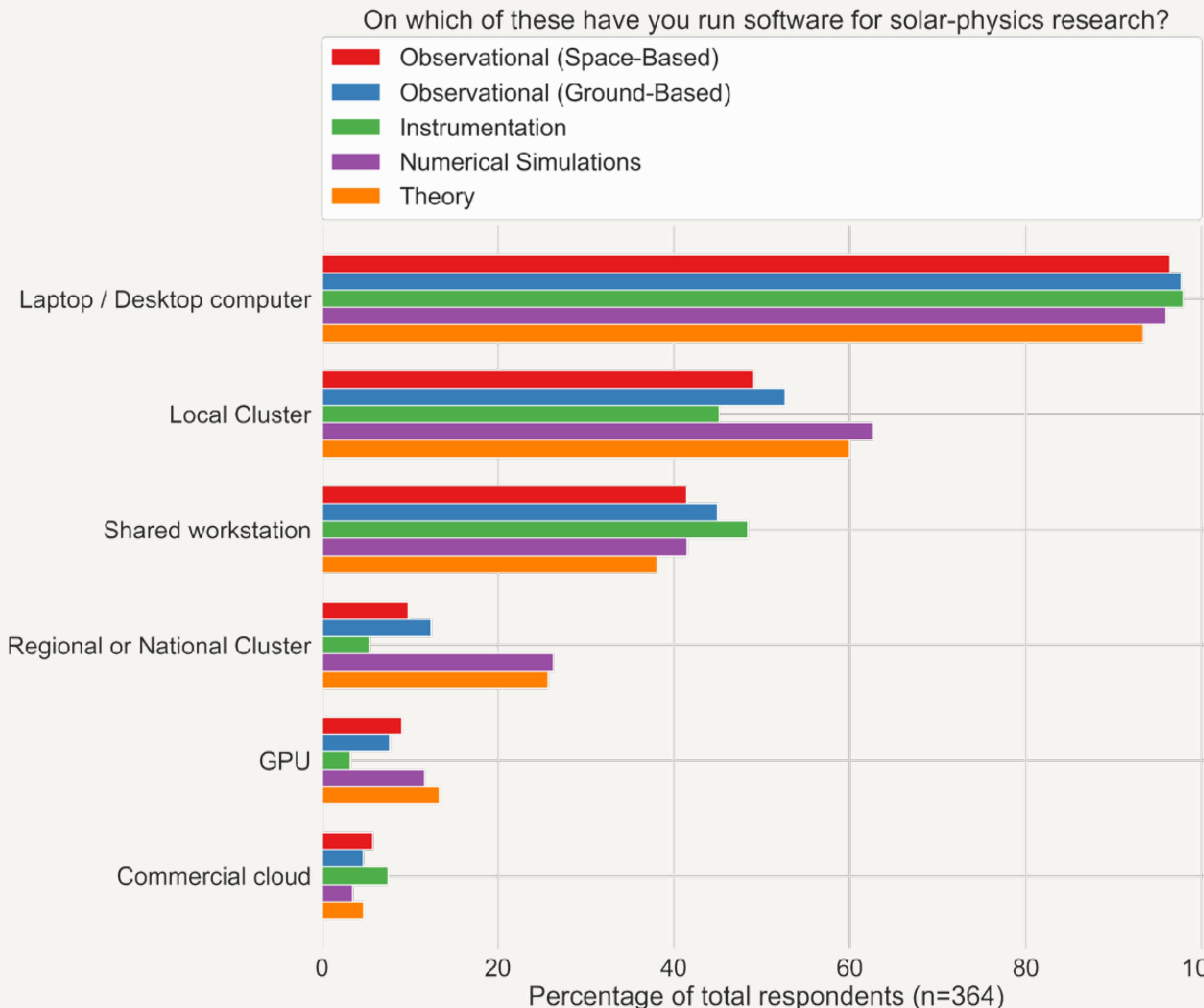
How did we (hopefully) gain visibility?



Community survey

Which of the following have you personally utilized in your work within the last year?





Papers

The SunPy Community, Will T. Barnes, Monica G. Bobra, et al. *The SunPy Project: Open Source Development and Status of the Version 1.0 Core Package*. 2020, *The Astrophysical Journal*, 890, 1.

+

Stuart J. Mumford, Nabil Freij, Steven Christe, et al. *SunPy: A Python package for Solar Physics*. 2020, *Journal of Open Source Software*, 5(46), 1832.

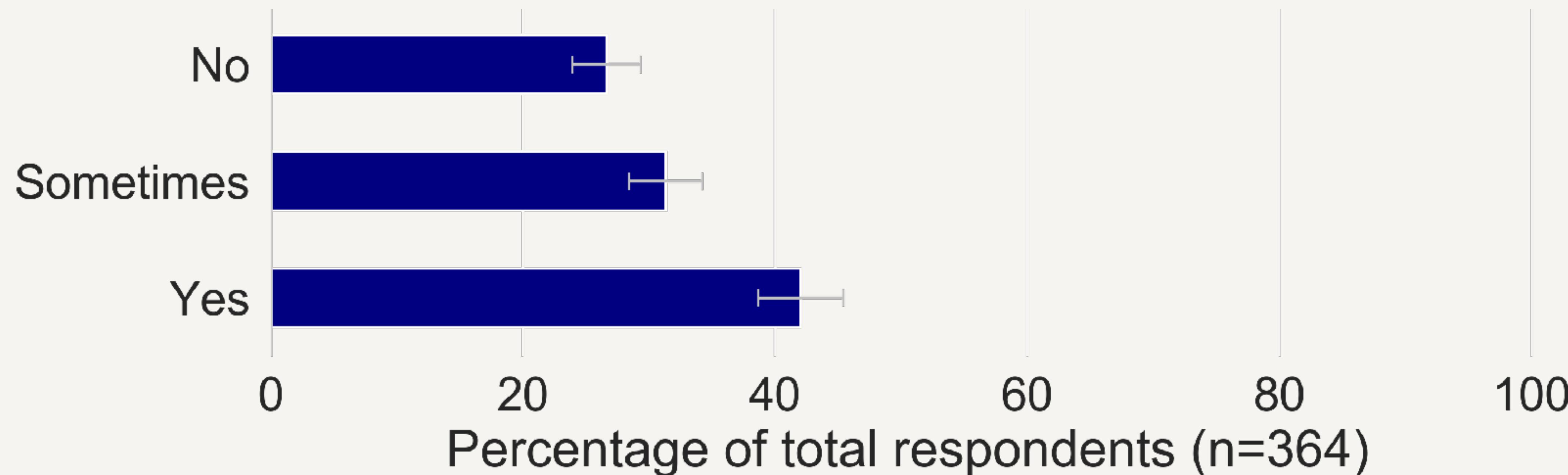
Papers

How did publishing papers help us?

1. We were formally recognized for scientific merit.
2. It gave us the opportunity to tell the community what we're trying to do. And to clarify these ideas to ourselves.
3. It gave people something to cite.

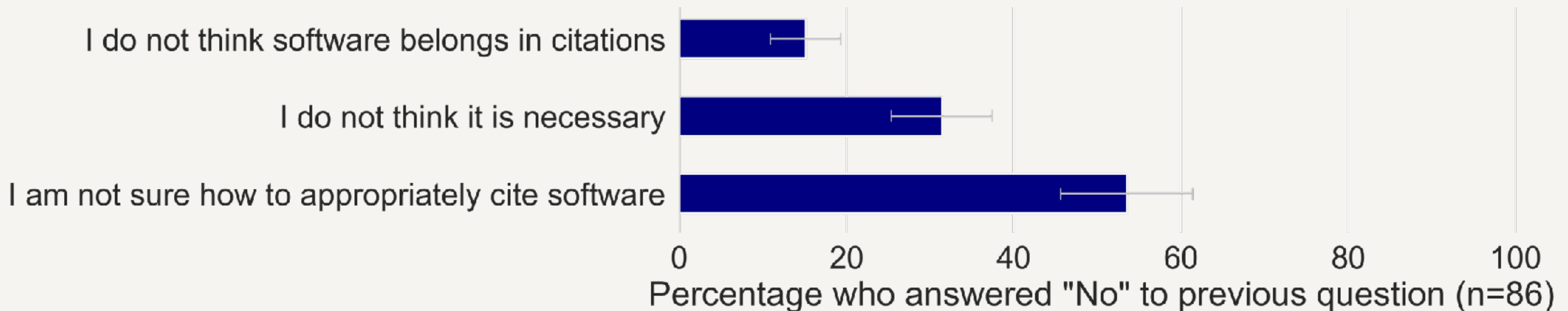
Citations

Have you cited software papers in your published research?



Citations

Why haven't you cited software in your research?



Funding

We won a NASA grant!

June 2018



NASA opened a solicitation
"to advance the goal of a
robust, vital, and cohesive
Python environment in
Heliophysics."

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We were selected!

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April 2020



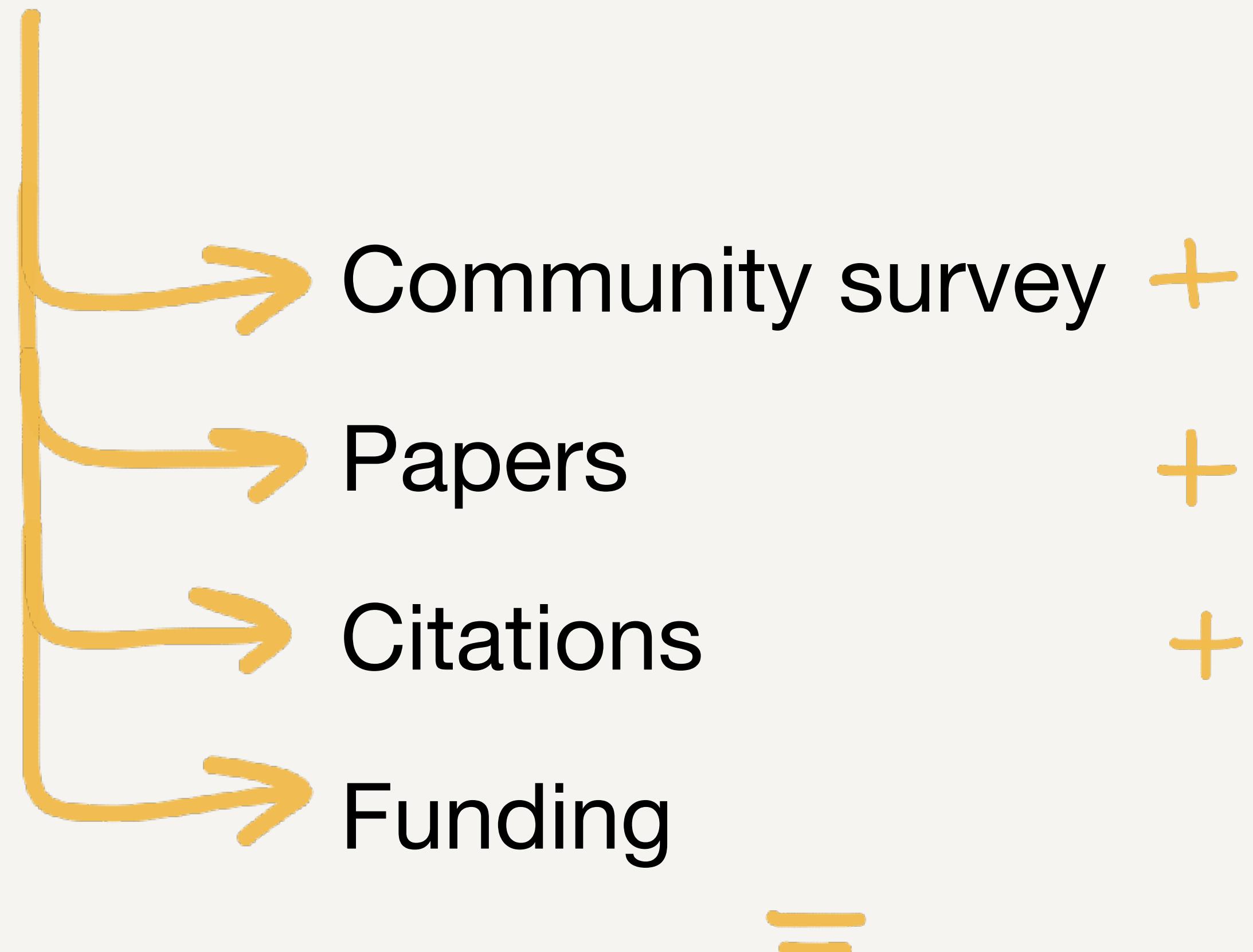
The SunPy Project decided to spend the money by hiring a developer.

Funding

Create opportunities

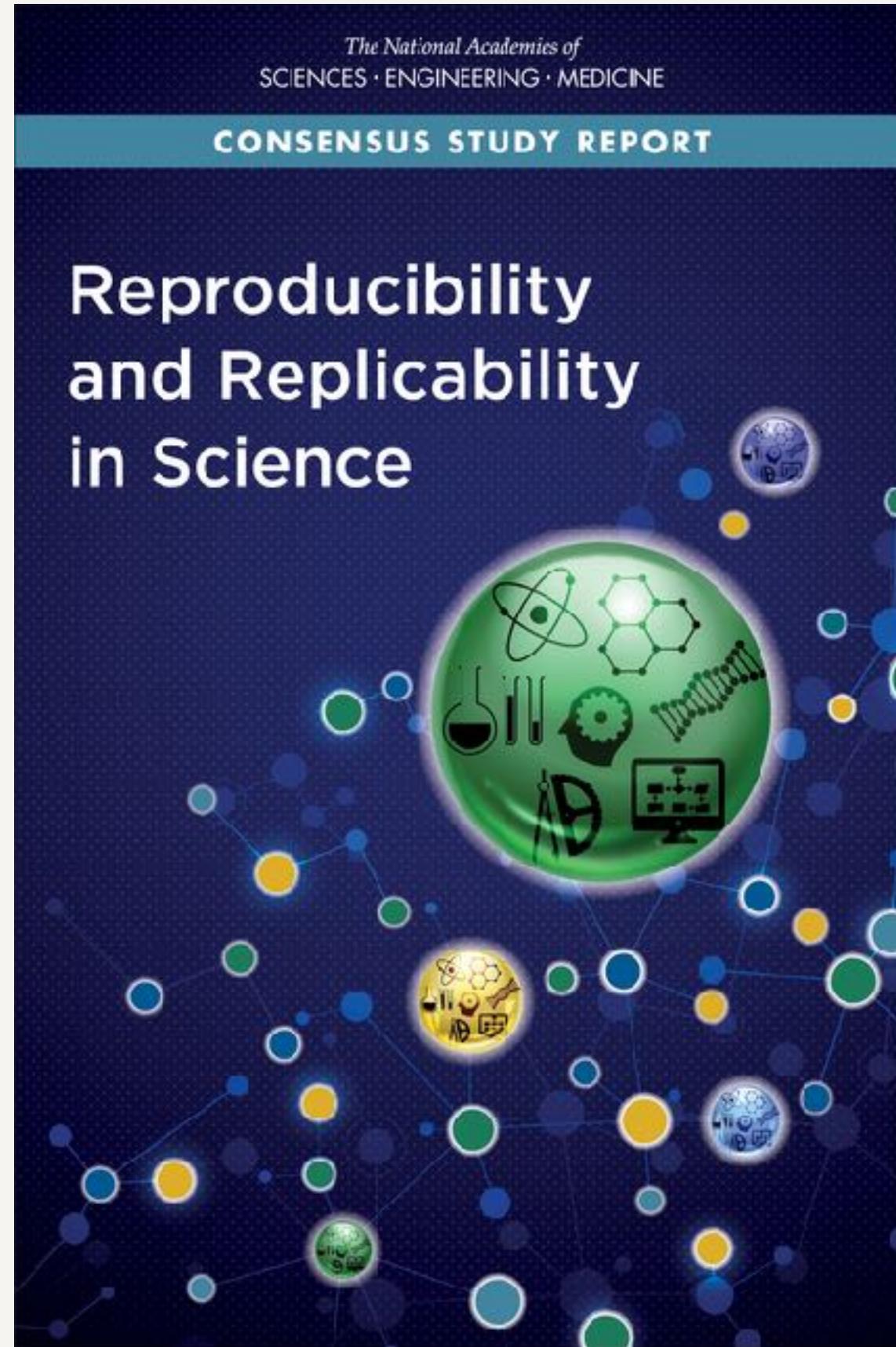
1. Talk to people at funding agencies.
2. Show them examples of awesome, new research that relies on open source scientific software.

How did we (hopefully) gain visibility?



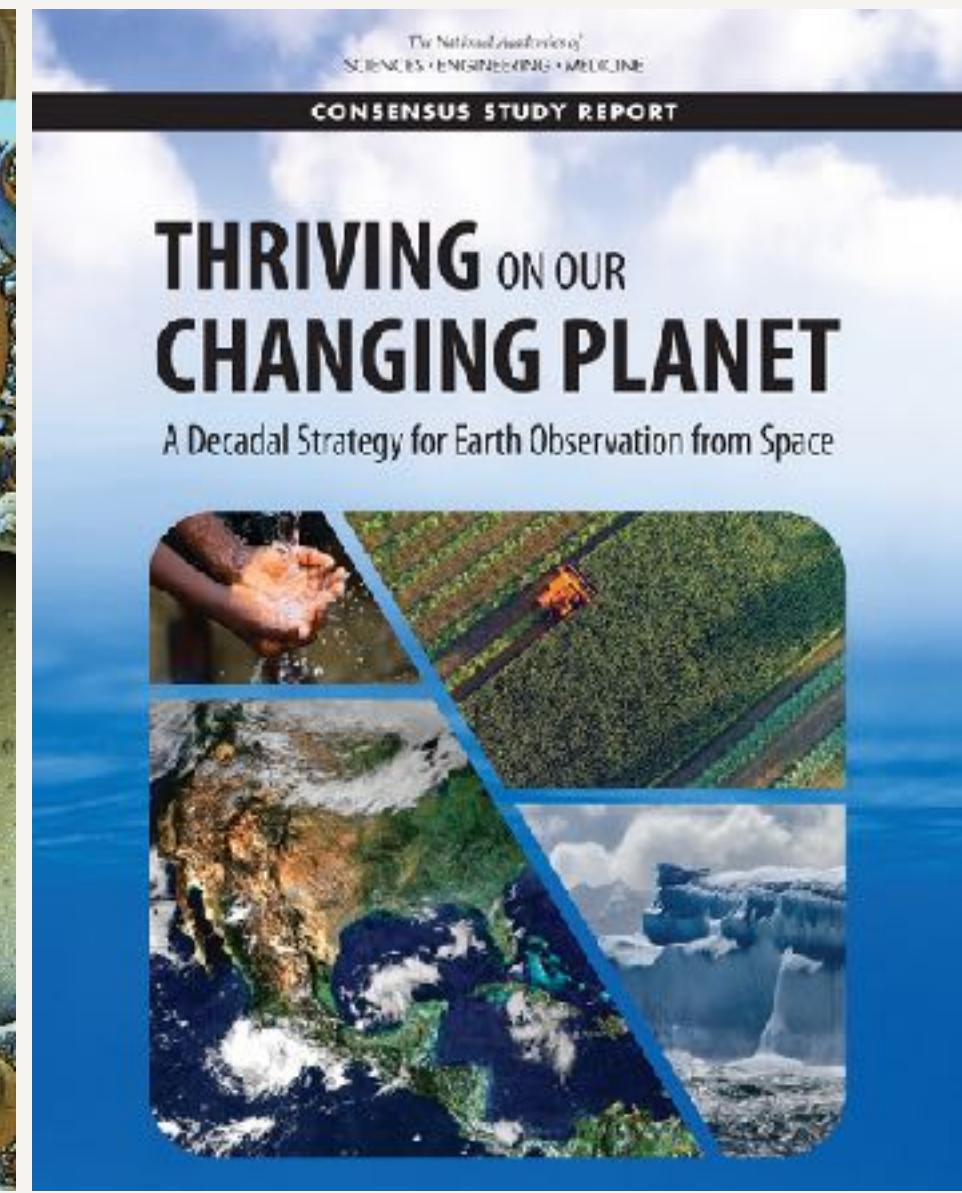
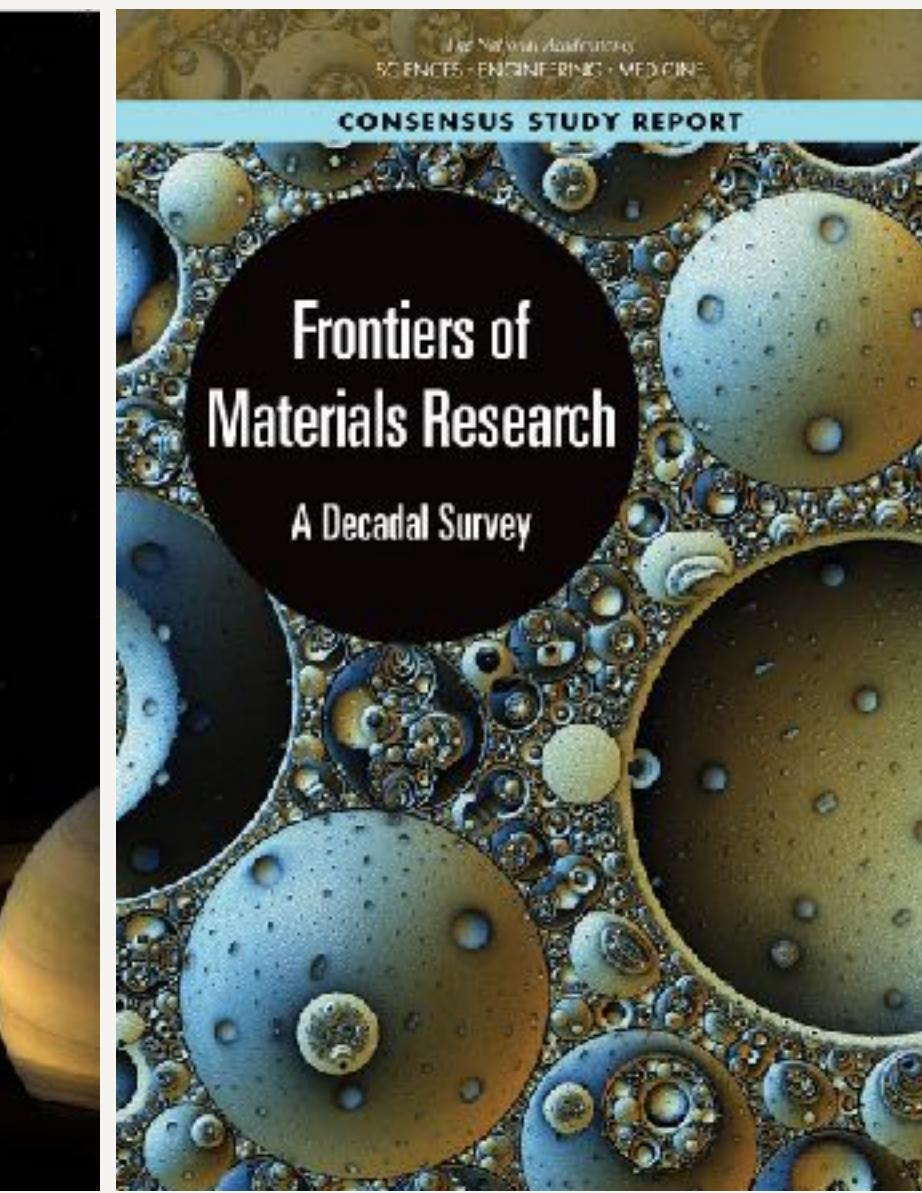
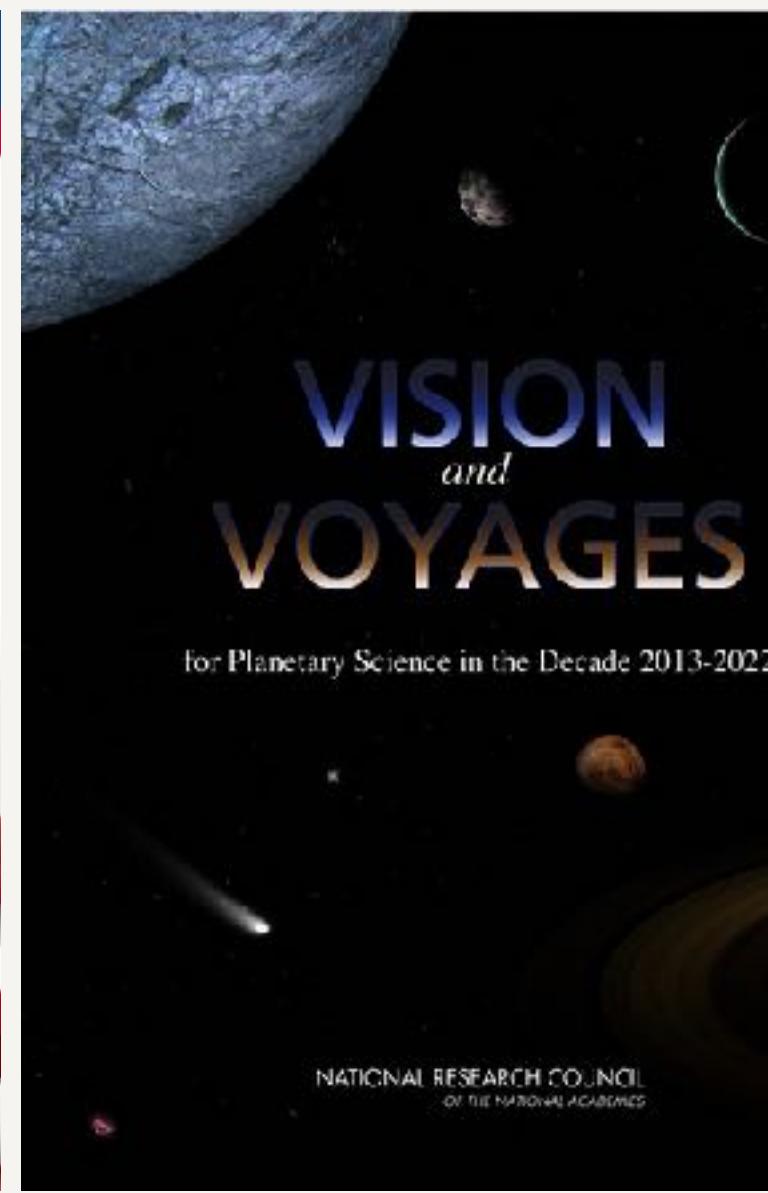
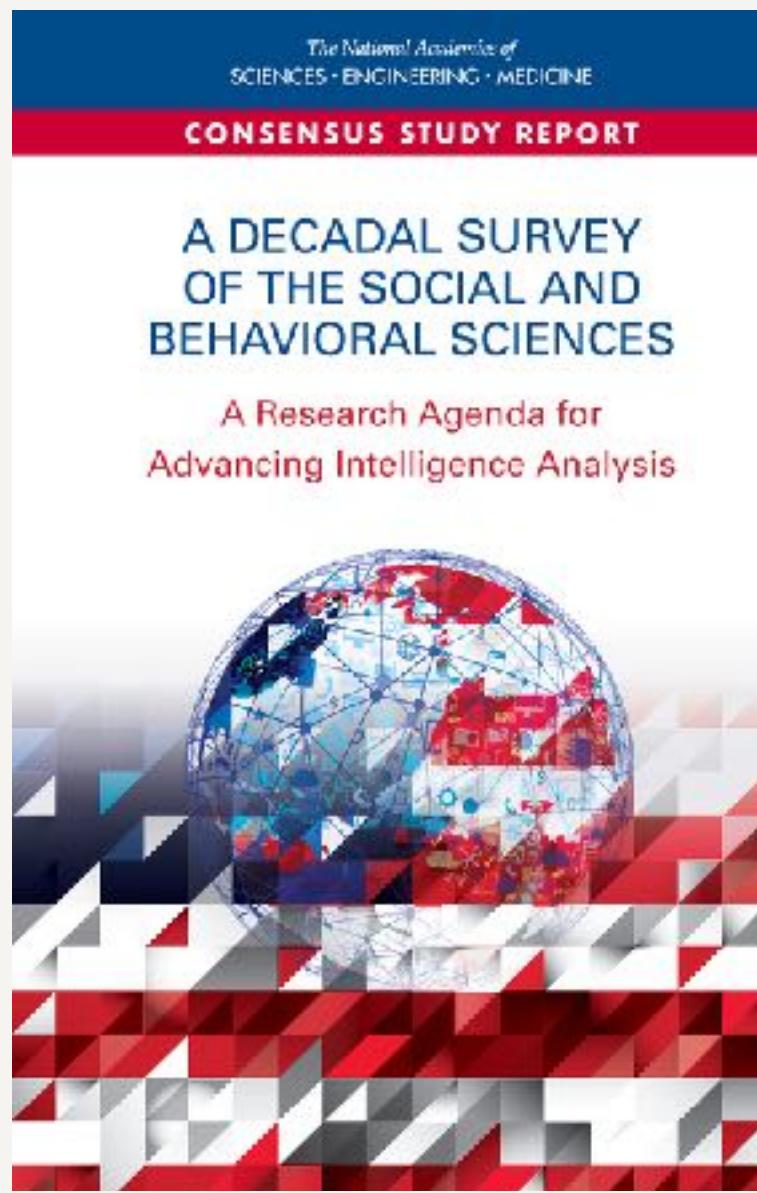
New science policies

Science Policy



"Recommendation 6-3: Funding agencies and organizations should consider investing in research and development of open-source, usable tools and infrastructure that support reproducibility for a broad range of studies across different domains in a seamless fashion."

Science Policy



National Research Council. 2015. *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*.

National Academies of Sciences, Engineering, and Medicine. 2019. *A Decadal Survey of the Social and Behavioral Sciences: A Research Agenda for Advancing Intelligence Analysis*.

National Research Council. 2011. *Vision and Voyages for Planetary Science in the Decade 2013-2022*.

National Academies of Sciences, Engineering, and Medicine. 2019. *Frontiers of Material Research: A Decadal Survey*.

National Academies of Sciences, Engineering, and Medicine. 2018. *Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space*.

PyHC

[Examples](#) [Blog](#) [Documents](#) [Meetings](#) [People](#) [Projects](#) [Contact](#)

Python in Heliophysics Community (PyHC)

Promoting and facilitating the use and development of Python for Heliophysics.

Find Python in Heliophysics at heliopython.org and SunPy at sunpy.org