Heliophysics on Education and Research using Cloud Computing

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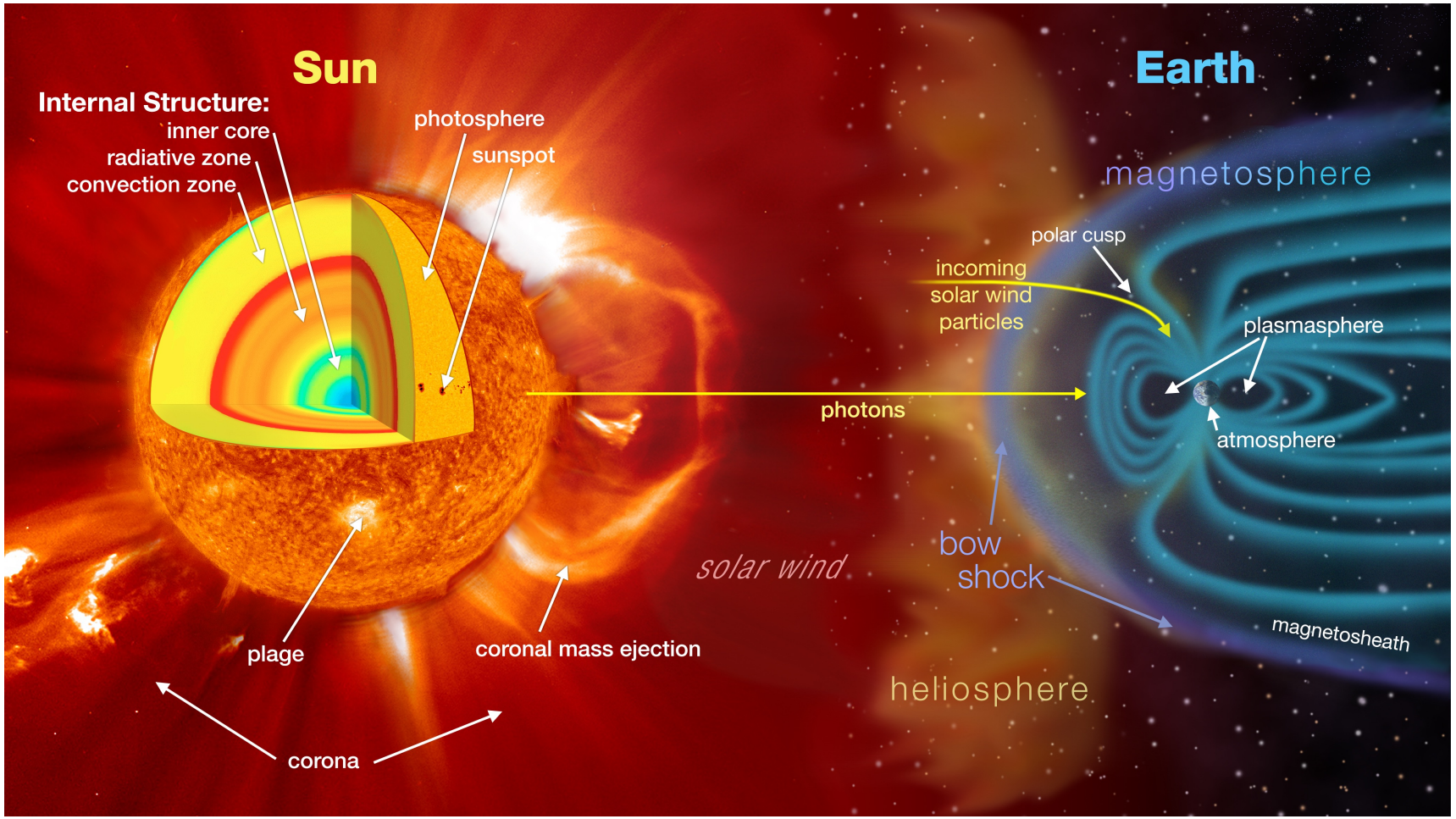
What is Heliophysics?

Heliophysics is the study of “the nature of the Sun and how it influences the very nature of space -and, in turn, the atmospheres of planets and the technology that exists there.”

[NASA Heliophysics Division Website]

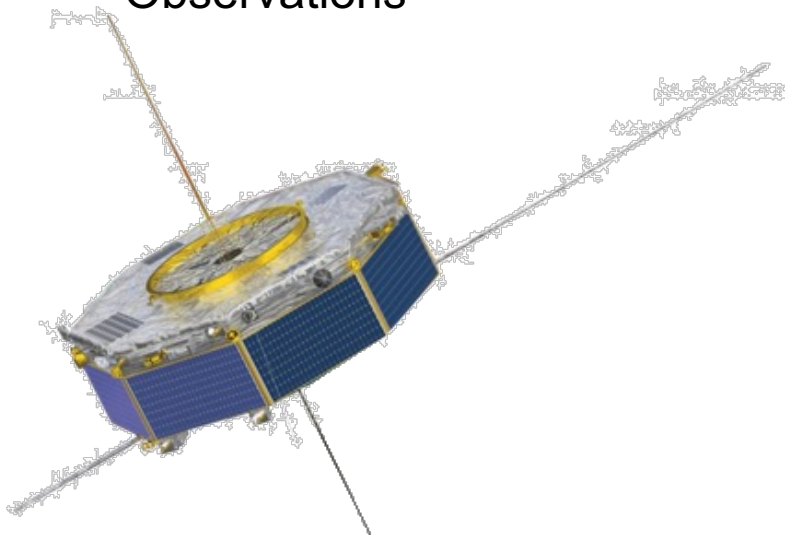


Research in Heliophysics

Observations

<u>In-situ</u>
(examples)

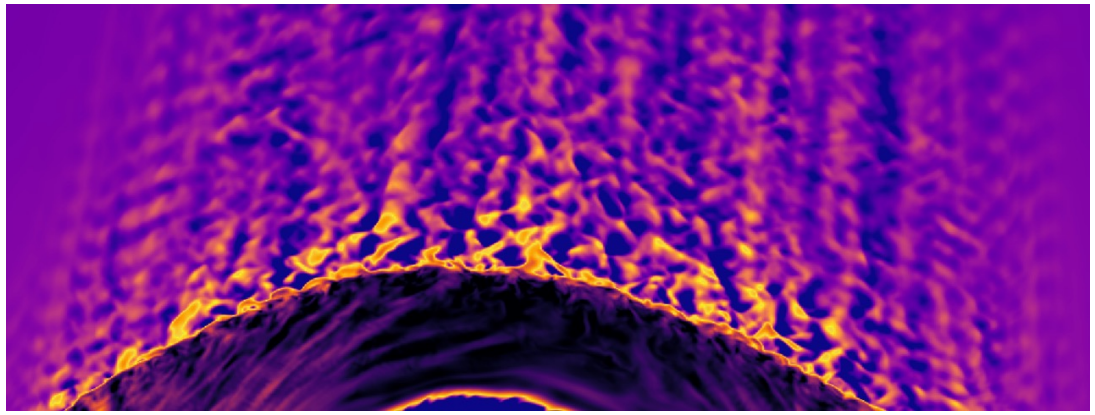
Cluster
MMS
THEMIS
Arase
ACE
WIND
PSP



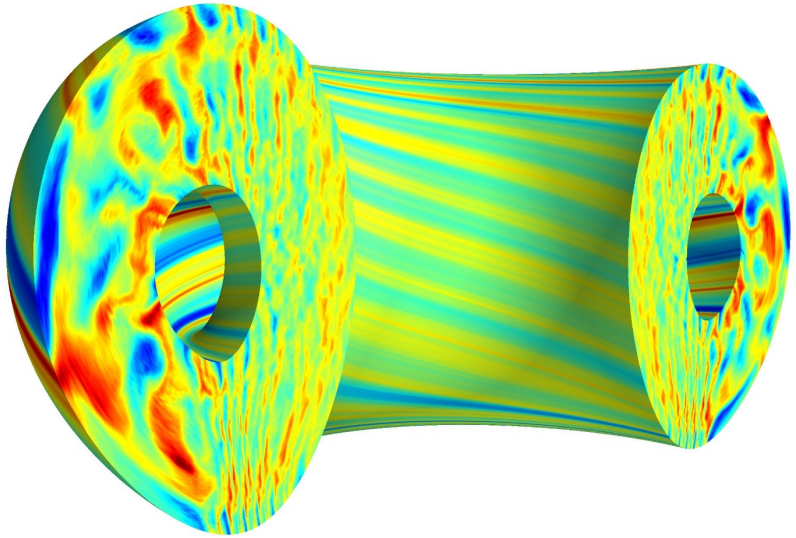
<u>Remote Sensing</u>
(examples)

SOHO
SDO
Solar Orbiter
SMILE

Simulations



Fluid, Hybrid, PIC, Monte Carlo

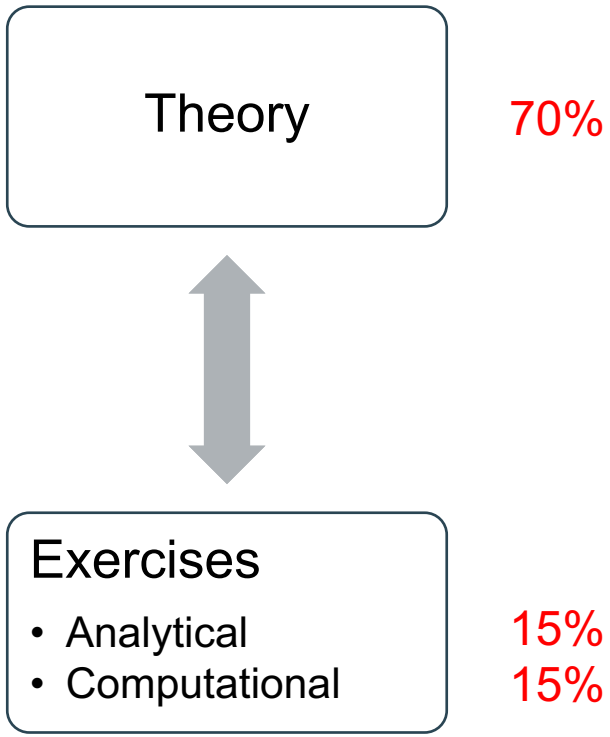


[Top]: MMS/NASA
[Bottom]: SDO/NASA

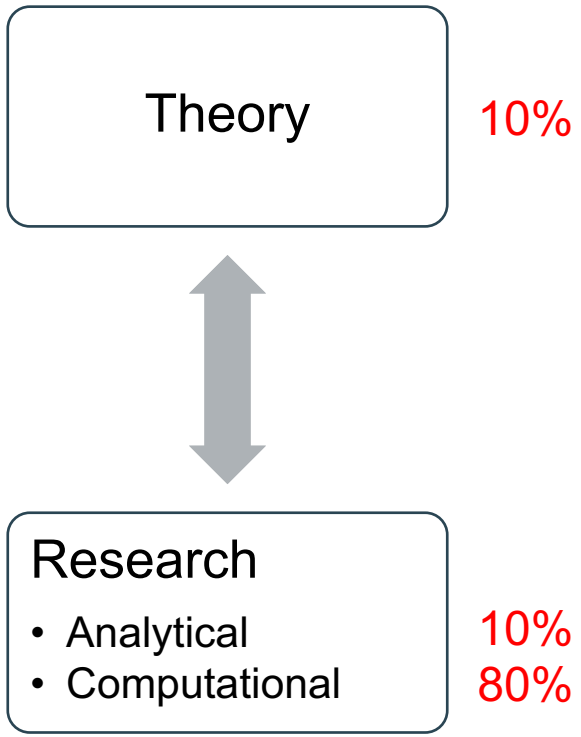
[Top]: M. Palmroth, Vasiator
[Bottom]: Emily Belli, General Atomics

Typical Course in Heliophysics vs Research

A course in Heliophysics



A researcher's day



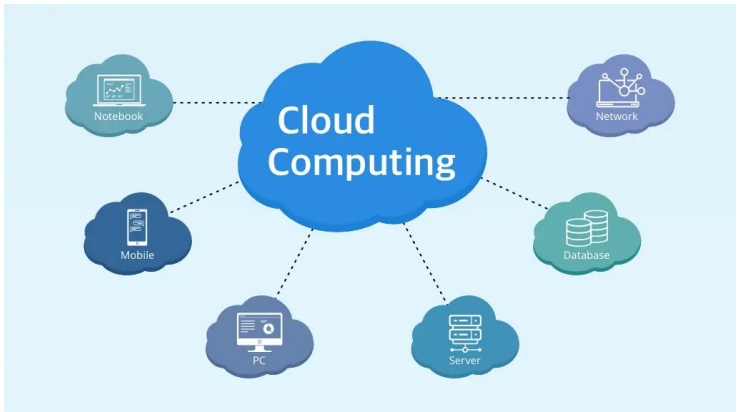
How do we **prepare graduate** students for a **future within and outside of our field**

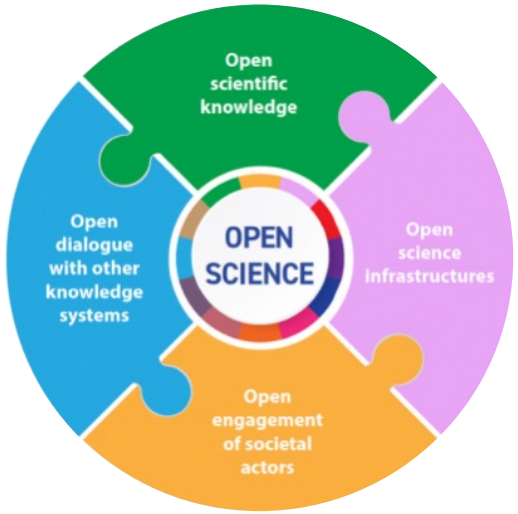
Reality of graduate student education

The code & data challenge

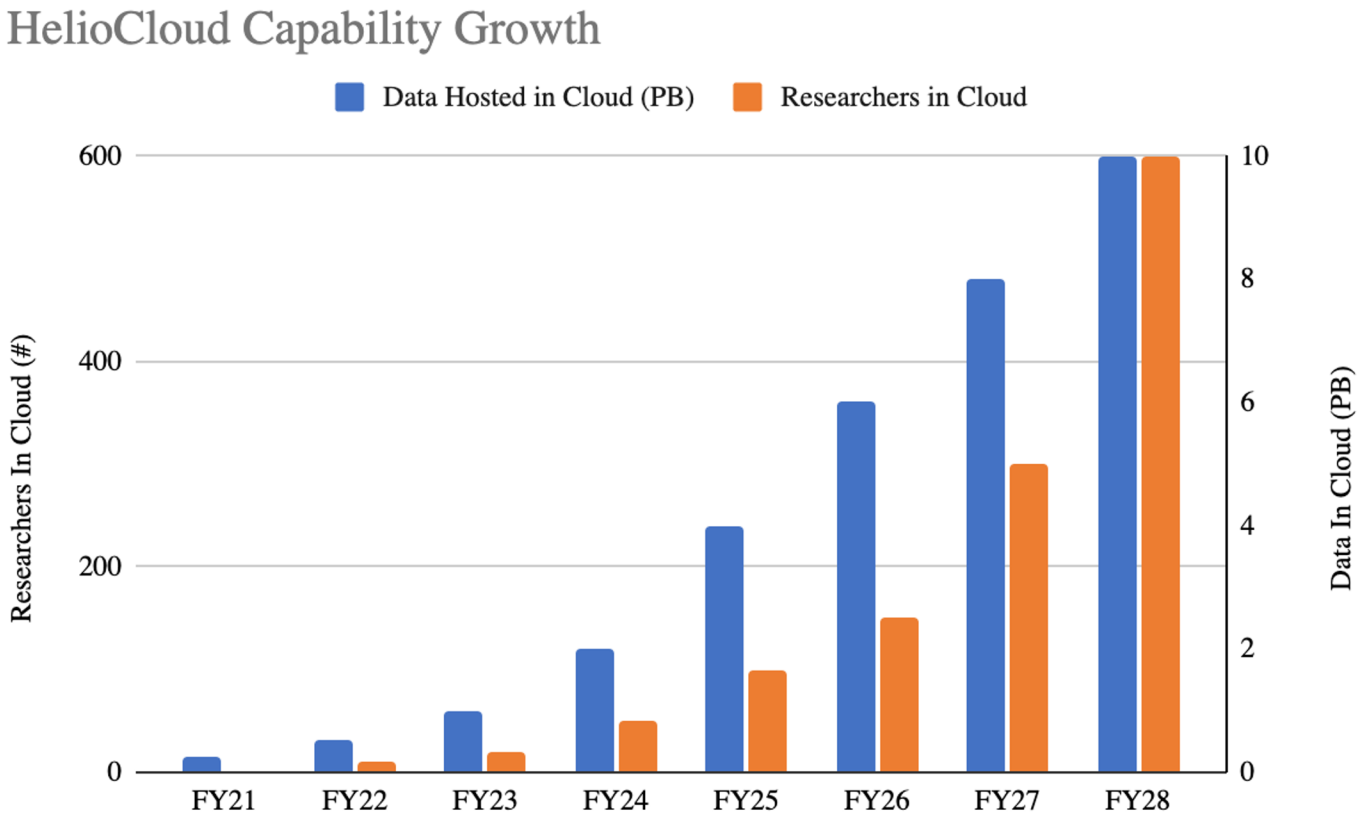
Things typically not tackled in curriculums:

- State-of-the-art algorithmic solutions to problems
- Community driven support & open science
- Data and code management and scaling





Heliophysics Cloud solutions



https://datalabs.esa.int

ESA DATALABS

CGS CENTER FOR GEOSPACE STORMS

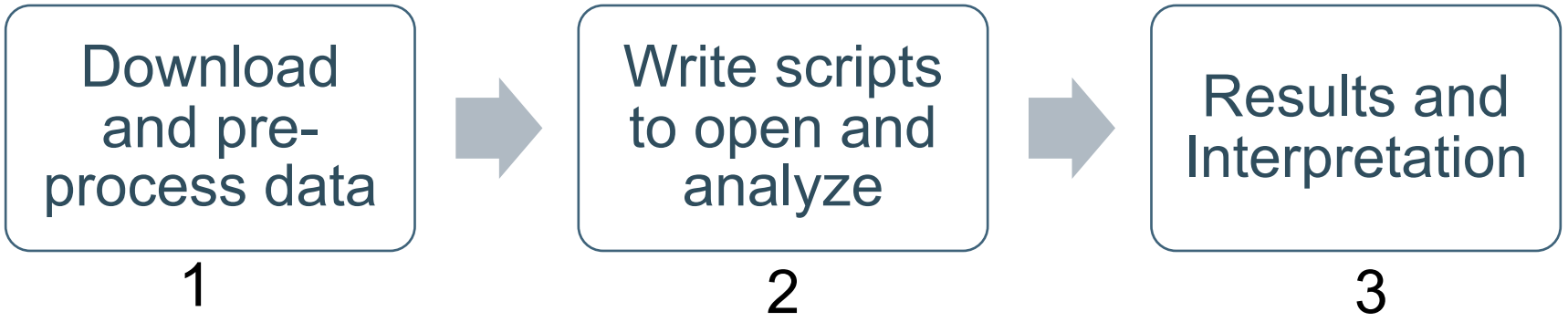
https://cgs.jhuapl.edu

HelioCloud

https://github.com/heliocloud-data/science-tutorials

https://heliocloud.org

Example – Observations problem



“Useful to do it once, tedious to do it all the time”

Task: Plot the magnetic field of MMS mission on 2019-09-14T07:54:00.000

Python in Heliophysics – More Opportunities

- What: PyHC package intros with focus on active student involvement and more!
- Why: Educate on and integrate students and early career scientists in PyHC software
- Where: At LASP (Boulder, CO, USA) and online everywhere on Zoom
- When: Monday, May 20th - Friday, May 24th 2024
- Who: undergraduate and graduate students, early career scientists, etc.!
- Cost: ***the event is FREE!***
- Important dates
  - Registration (required): due by **April 29th**
  - NSF travel support applications: due by **April 29th**
  - Hotel block: prior to cut off date of **April 19th**
  - Poster submission: due by **May 6th (11:59 PM MT)**

pyhc.org/summer-school-24