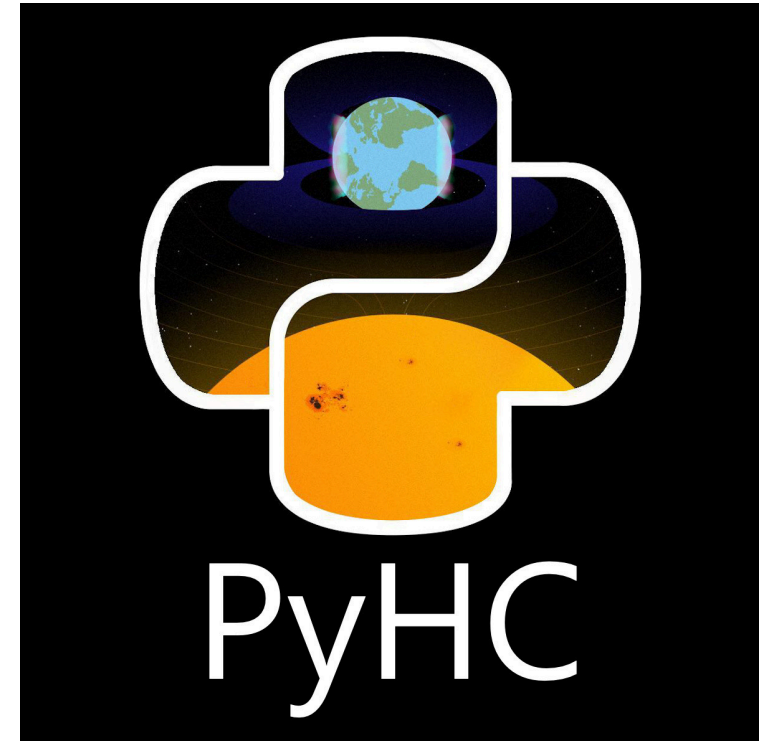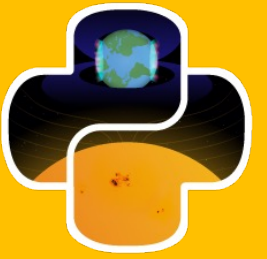# PyHC: updates and advancing community innovation

Julie Barnum

LASP | University of Colorado Boulder

CEDAR, June 30th, 2023

PyHC Updates

- New Packages
  - Packet decomposition (Space-packet-parser, CCSDSPy)
  - Solar radio (LOFAR-Sun)
  - PSF manipulation/correction (regularizePSF)
  - Data Analysis (XRTpy)
  - Data management/visualization (GeospaceLAB)
  - Instrument Control/Telemetry (SkyWinder)
- Current Package Upgrades
  - Kamodo and HAPI moved to PyHC core package status
- General Website Improvements
- Meetings
  - AGU 2022, fall 2022/spring 2023 meetings, etc.

PyHC Updates
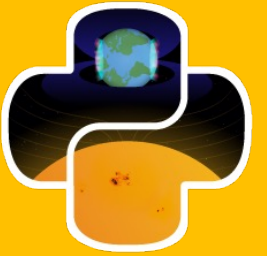
- Papers
  - Python in Heliophysics Community (PyHC): Current status and future outlook
    - First author: Julie Barnum
    - DOI: https://doi.org/10.1016/j.asr.2022.10.006
    - Content:
      - How has PyHC realized the tenants of a "Heliophysics Framework" put forth by Burrell et al. (2018)?
      - Discussed how to advance PyHC's efforts, including ways in which we can improve our information architecture, how we can grow our community, both in terms of project sustainability and usage, as well as the social component of the community itself, how we can improve PyHC package integration, and finally, non-Python library considerations.
  - Making an executable paper with the Python in Heliophysics Community to foster open science and improve reproducibility
    - First author: Shawn Polson
    - DOI: https://doi.org/10.3389/fspas.2022.977781
    - Content:
      - Created a collaboration between software developers/engineers and scientists,
      - used multiple PyHC packages to perform a science analysis,
      - produced an executable paper in Heliophysics, and
      - showed how such a collaboration supports open science.
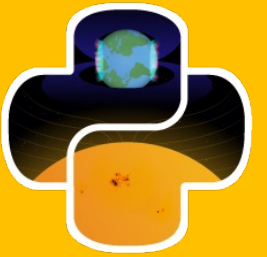
PyHC and Mission Engagement

- Issue
  - Leveraging grass-roots good will for better software goes so far, but to make mission-level capabilities, we need to fuse the community efforts with the mission activities.
- Ideas
  - Get involved with missions ***early***
  - Help educate on OSS and open science processes
  - Invite to PyHC telecons, meetings, perhaps our Summer School?
- Implementation example
  - Julie is speaking with the scientists in the Geospace Dynamics Constellation mission (GDC) in July.
  - Informing them more on PyHC and how we can integrate our capabilities into the mission, early on!

PyHC and pyOpenSci

- pyOpenSci
  - https://www.pyopensci.org/
  - "build diverse community that supports free and open Python tools for processing scientific data. We also build technical skills needed to contribute to open source and that support open science."
  - Includes a package review process that is paired alongside JOSS publications, helps mature community standards, guidance on packaging.
- Currently partnered with Pangeo, and astropy is also in the works
- Help us "set the standard" for community standards and processes

Peer review of Python software to support open science

Software Peer Review

Python Package Peer Review

We offer peer review of Python software to increase the quality, usability and long term maintenance of the open source tools that drive open science. JOSS accepts our review as theirs so you can get the benefits of pyOpenSci and JOSS through one review.

> Learn more about the benefits of peer review.

Community Partnerships

Community Partnerships

We partner with domain-specific scientific Python communities such as Pangeo who want to review affiliated packages. Through this collaboration we develop develop community-specific standards that are used in our reviews, to evaluate whether a package meets affiliation requirements. This removes the need to communities to develop their own peer review process.

> Learn More About Our Community Partners

**Python Packaging Guide**
Community Driven

Simplifying Packaging

We are creating a beginner-friendly, **community-driven Python packaging guide**. Our guide is reviewed by members of the Python Packaging Authority, maintainers of core packaging tools and members of the scientific Python community. It recommends best practices for you to follow when creating a Python package.

> Check out our Python packaging guide

Credit: pyOpenSci website

PyHC Summer Schools
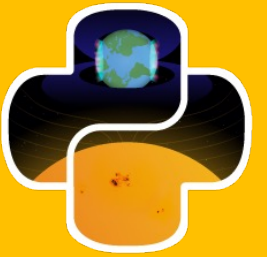
- Summer School 2024
  - Continue education of students and early career scientists in the software capabilities available through PyHC.
  - Create a more diversified community, ensuring the continued growth of both PyHC in and of itself, as well as its utility to the broader solar and space physics community.
  - Encourage and promote the use of OSS and open science.
  - Great motivation to continue working on package interoperability and identify better ways to coordinate among conceptually similar packages so that we can really start leveraging Open Science to create more durable analysis capabilities.


PyHC 2022 Summer School Attendees (credit: Stuart Mumford)

PyHC and AI
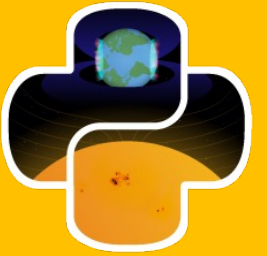
- Integration of AI capabilities into PyHC
- Shawn Polson (PyHC Tech Lead) presented on this at our spring 2023 meeting
  - Where can we integrate things like chatGPT to make our workflow more efficient
  - His vision: "PyHC Chat", a one-stop-shop to learn anything PyHC, it'll do your research, write your code, then write your paper too, accomplish PyHC goals with amazing speed, and be a developer bot floating around GitHub
- See recordings on the PyHC YT: https://www.youtube.com/@pythoninheliophysicscommun3732
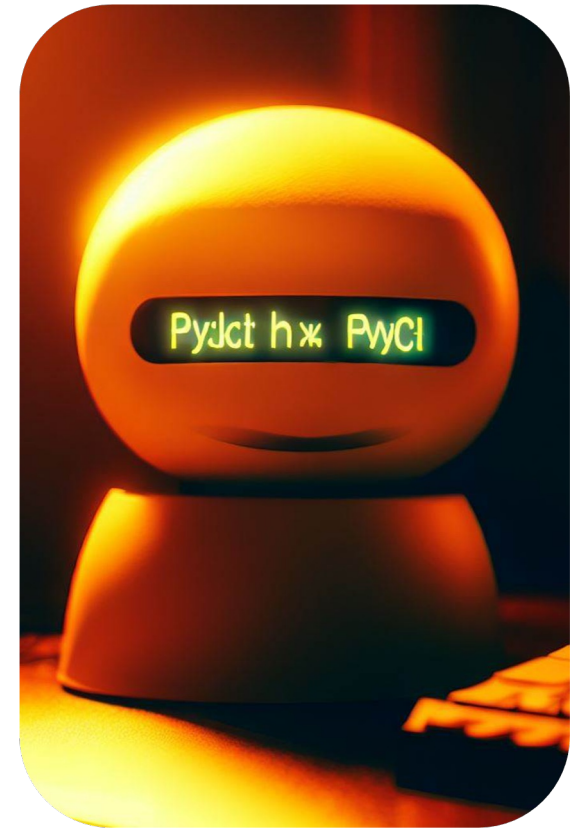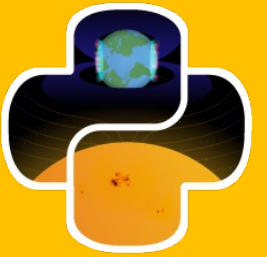
PyHC: other community efforts

- The PyHC Open Science Experiment
  - Goal: expand capabilities shown in the PyHC executable paper to a full-blown science problem), further demonstration of how to perform open science in Heliophysics, and improve and develop modern infrastructure to streamline collaboration and contributions.
  - Partnered with the Center for Open Science (specifically leveraging the open infrastructure OSF); https://www.cos.io/
    - "…help researchers conduct research more rigorously, and manage and share their work more openly."

- HelioCloud
  - Goal: enable distributed researchers to discover, share, publish, collaborate and work with very large collections of research artifacts.
  - Based in the AWS cloud (open science in the cloud).
  - Cheap data/software storage.
  - Collaboration through Jupyter notebooks.

See recordings on the PyHC YT: https://www.youtube.com/@pythoninheliophysicscommun3732

Connect with PyHC

- Website: pyhc.org
  - Upcoming telecon and meeting info on the Meetings page, PyHC packages info on Projects page, etc.
- PyHC mailing list
  - https://heliopython.org/contact/
- PyHC Slack space: https://join.slack.com/t/pyhc/shared_invite/zt-1ugv3zqky-yOqPrh4sbPJ_2VVYoO8ziw
- Consider submitting an abstract to the PyHC 2023 AGU session!
  - Session: https://agu.confex.com/agu/fm23/prelim.cgi/Session/189609
  - Abstracts due by **Wednesday, 2 August 2023 at 23:59 EDT**
- Further questions? Drop me a line. ☺
  - Julie.Barnum@lasp.colorado.edu