

hxform and Coordinate Transform Standards

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Interoperability between Python Packages
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Outline

1. [hxform](#)

- Thin wrapper for coordinate transforms with back-ends of SpacePy (Native Python and IRBEM Fortran versions), [Tsyganenko's Geopack-08 library](#) (Fortran), [cxform](#) (c); Spiceypy and SunPy support may be added.

2. Space Time Coordinate Transform (STCT) Standards Working Group

- See [Draft Poster](#) and [Meeting Notes](#)
- Motivation: Experience with HAPI and hxform

3. Answers to Rebecca's Questions

1. hxform

- Thin wrapper for coordinate transforms with back-ends of SpacePy (Native Python and IRBEM Fortran versions), [Tsyganenko's Geopack-08 library](#) (Fortran), [cxform](#) (c); Spiceypy and SunPy support may be added.
- Motivation: Not one lib worked as-needed for all projects due to speed, compilation issues, up-to-date IGRF, needed transforms, bugs, etc.
- Has in-development code for intercomparing results and demos for non-wrapped packages such as SpiceyPy and SunPy.
- Not quite ready for sharing; developed for use by my students but not the general community (no pip install, docs need work, some poor implementation choices).

2. STCT Standards Working Group

NASA-sponsored project; started this year. Involves

- the development of a comprehensive standard for acronyms and definitions

and, at some level,

- the implementation of comprehensive software, services, and unit tests for coordinate transforms; and
- understanding the uncertainty of transforms due to implementation choices.

3. Answers

1. Why did your package choose the current method for coordinate representation and conversion?

Decision was based on 1. Ease to get working, 2. What worked for my given application.

3. Answers

2. What in Astropy coordinates is missing or incompatible with heliophysics coordinate systems & transformations in your work?

Does not support many common heliophysics transforms out-of-the box.
Much time to learn their interface and conventions.

I need to know if it fast for many transforms and how it handles IGRF updates?

3. Answers

3. If AstroPy is enough for your application, what changes need to be made in your software to adopt Astropy?

Comprehensive support of all existing transforms (those provided by SpacePy, cxform, and GEOPACK)

Very clear instructions on how to add new transforms.

3. Answers

4. If AstroPy is not enough, what capabilities are missing?

I am not sure if AstroPy is option I want.

Does it make sense for AstroPy to support transforms that require field line tracing? This will add many dependencies.

3. Answers

5. What do we need and what will that look like?

An important issue to work out is the fact that AstroPy (and SpiceyPy/SPICE) and Heliophysics developers work in fundamentally different ways.

AstroPy/SpiceyPy/SPICE transform implementations account for more details. Heliophysics packages tend to be much easier to use, but omit options for possibly important details.

Current preference is for SpiceyPy/SunSpice/SPICE approach because it does one thing only, all details are stored in files that can be used in many languages, and it is what Heliophysics missions often use.