



# PlasmaPy: An open source Python package for plasma research and education

The PlasmaPy Community: N. A. Murphy, D. Stańczak, E. Everson, J. Beckers, K. Bryant, S. Fordin, P. Heuer, F. Khan, P. Kozlowski, S. Langendorf, A. Leonard, R. Malhotra, B. Maruca, S. Mumford, T. Parashar, A. S. Richardson, D. Schaffner, D. Stansby, F. Tamboli, R. Qudsi, T. Varnish, and S. Vincena

We acknowledge support from:



- The heliosphere is mostly plasma
- Laboratory plasma experiments help us understand heliospheric processes
- Heliophysics allows in situ study plasma processes in regimes inaccessible in the laboratory
- Plasma physics functionality is needed for a data/software ecosystem for heliophysics

# The PlasmaPy Project

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plasmaPy

## Mission

*To grow an open source **software ecosystem**  
for plasma research & education*

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- **PlasmaPy core package**
  - Most frequently needed functionality
  - Currently under active development (now at version 0.4.0)
- **Affiliated packages**
  - Will contain specialized functionality
  - To be created by broader community
- **Educational resources**
  - Introduce plasma concepts using PlasmaPy
- **Community**
  - Informal online community meetings & virtual “office” hours
  - Code of conduct

## `plasmapy.particles`

- Object-oriented representations of ions, electrons, and fundamental particles

## `plasmapy.formulary`

- Commonly needed formulae for plasma parameters and transport coefficients

## `plasmapy.simulation`

- To include building blocks of plasma simulations and an improved particle tracker

## `plasmapy.analysis`

- Analysis techniques for data from simulations, experiments, and observations

## `plasmapy.diagnostics`

- For representations of plasma diagnostics such as Langmuir and magnetic flux probes, as well as synthetic diagnostics

## `plasmapy.dispersion`

- To contain dispersion relation solvers for plasma waves

## `plasmaPy.plasma`

- Base classes to represent different plasmas

## `plasmaPy.utils`

- Helpful tools for the rest of the package

## `plasmaPy.tests.helpers`

- To contain an improved test runner that simplifies writing tests

## `plasmaPy.addons`

- Entry point for affiliated packages to be put in PlasmaPy namespace

- Well-documented & well-tested code
- Reliable code with validated physics
- Improved interoperability
- Less duplication of functionality
- Lower code development costs
- Open, reproducible, and efficient research
- Community-driven development



- Reduce barriers to entry
- Improve transfer of knowledge
  - Documentation describing code & physics
- Provide tools for plasma education
  - Introduce plasma concepts using PlasmaPy
  - Classroom exercises
- Introduce collaborative code development practices
  - Provide students with skills beyond the classroom

- **Open metadata standards**

- Few data schemas exist for laboratory plasma science
- Harder to develop shared analysis tools
- Laboratory plasma scientists could emulate IHDEA

- **Improve interoperability**

- Heliospheric processes are studied in the laboratory
- Enable cross-disciplinary studies with shared standards & tools
- Beneficial for both fields

- **PlasmaPy** is a Python package for plasma science
  - Development is well underway
  - Version 0.5.0 release planned in next few months
- The software & data environment for heliophysics and plasma science need interoperability
  - Participation in the Python in Heliophysics Community
  - (Hopefully!) future collaboration with IHDEA

- Join the conversation!
- Become an early adopter
- Encourage students to become involved
- Request new features
- Contribute code, tests, and documentation
- Team up as a participating project
- Include PlasmaPy contributions in proposals