Review of Cometary Afρ Data

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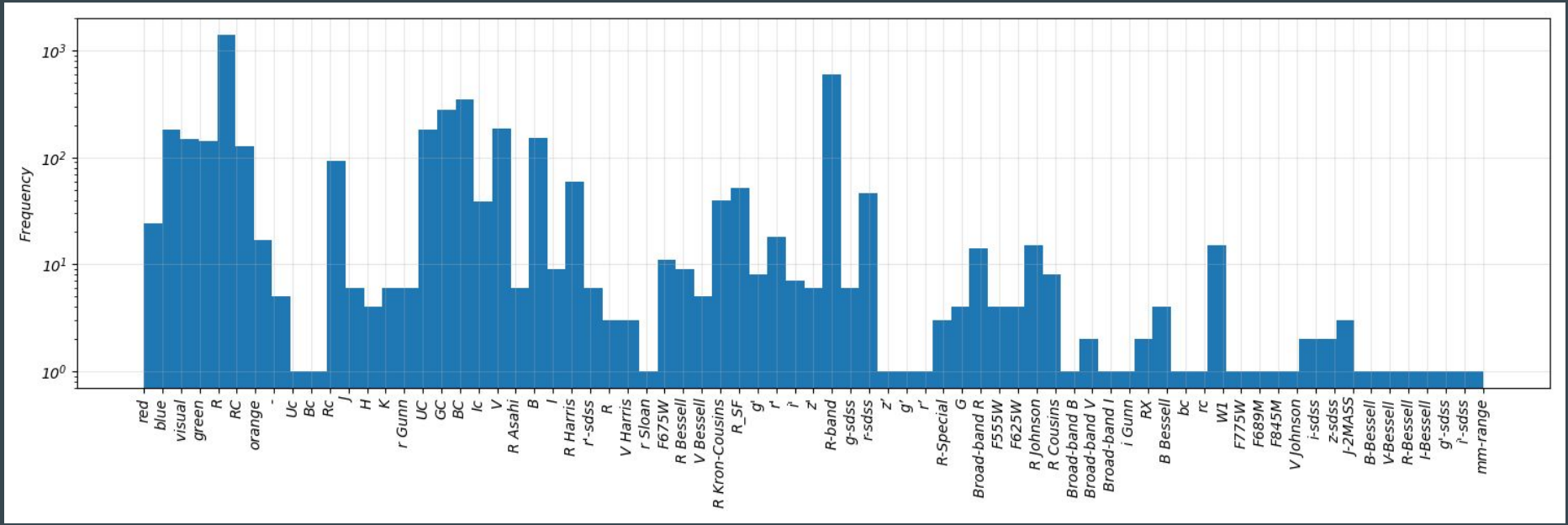
Dataset Description

- CSV file with 334 comets between 1976 and 2023, 4350 total records, collected from ~100 papers
- The csv file has 18 columns:
  - Comet's name,
  - Classification
  - Perihelion distance (au)
  - Date of observation
  - Heliocentric distance (au),
  - Geocentric distances (au)
  - Phase angles (degrees)
  - Orbital branch
  - Bandpass
  - Pixel scale (arcsec per pixel)
  - Aperture radius (arcsec)
  - Projected aperture radius (km)
  - Afρ (cm)
  - Afρ uncertainty (cm)
  - Gas-to-dust ratio
  - Reference
  - DOI
  - Link to NASA ADS

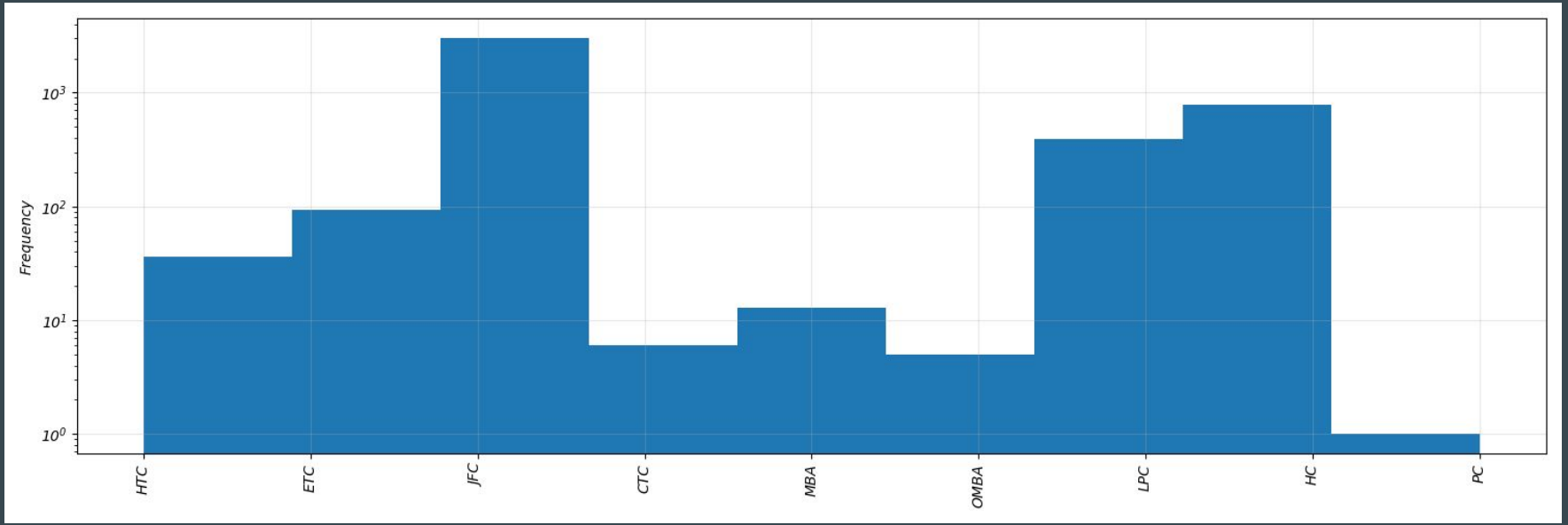
Data Access and Investigation Tools

- Data accessed with Python and pds4_tools Python package.
  - Additional packages for reading .csv file: Pandas, NumPy
- Data were easy to read in, plot, and manipulate.
  - Loaded in tables via Python Pandas “read_csv”
- All files were readable with pds4_tools Python Package
  - No errors produced
- IPython Notebook used for review available on request

Bandpasses Used - Degeneracies?



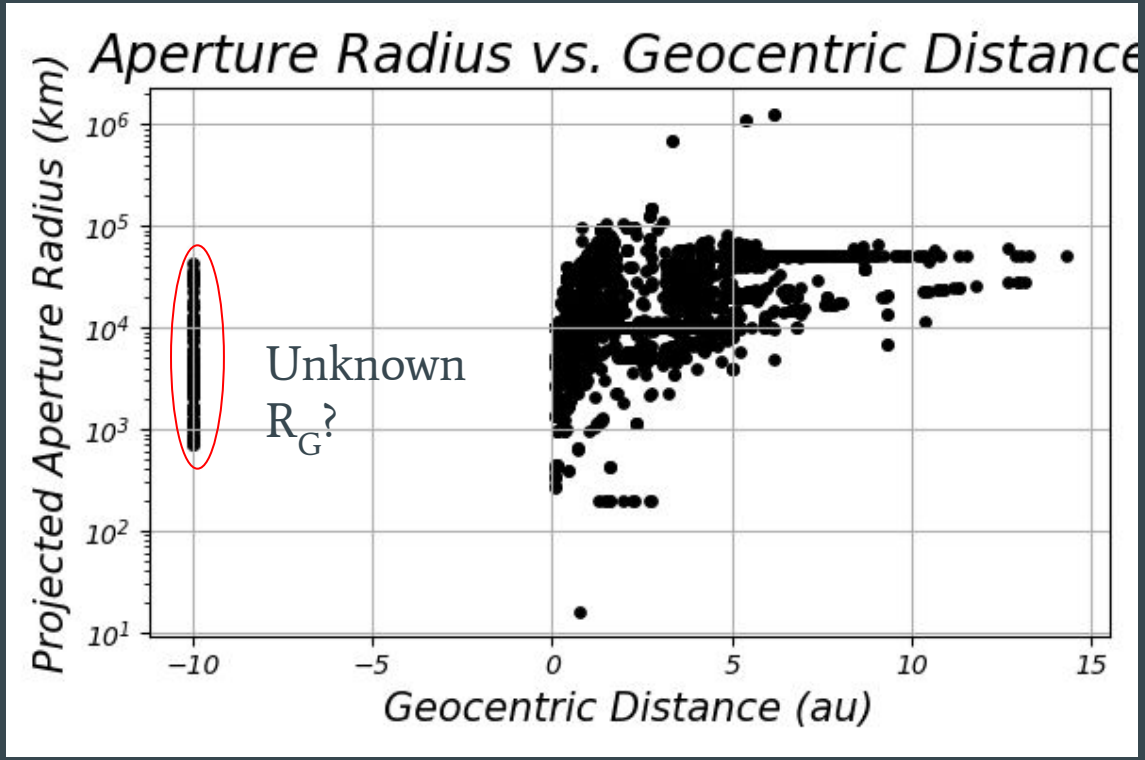
Dynamic Classifications



PDS SBN Review, Oct 16, 2025 - Cometary Afρ Dataset

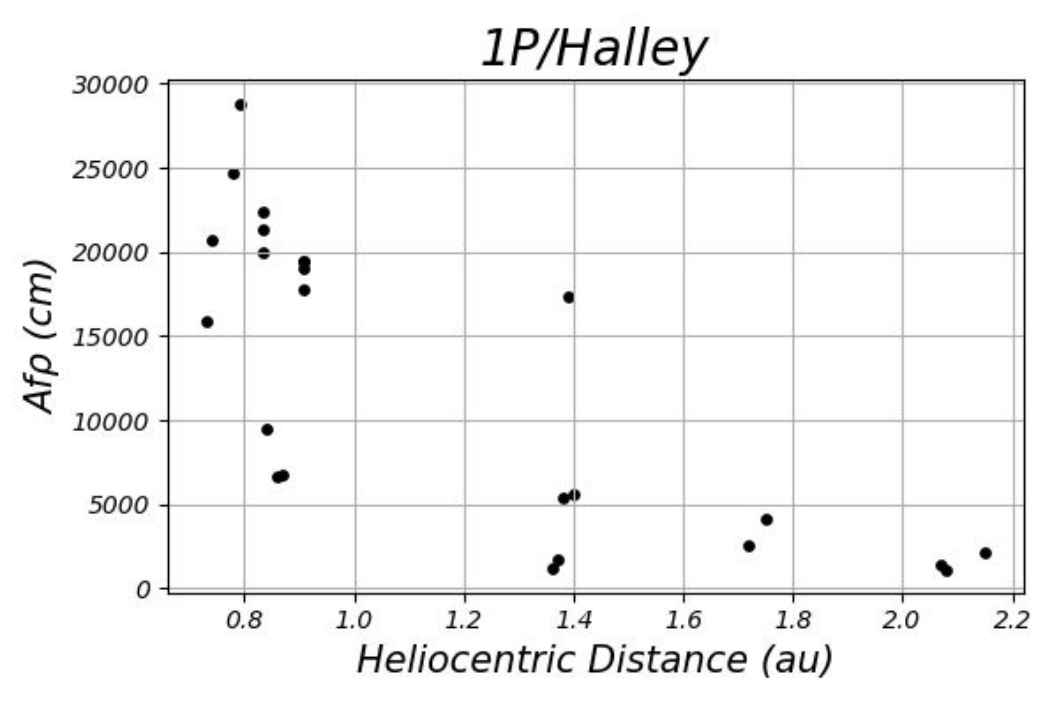
Aperture Radii

- Trend as expected, with some clear error message codes (-9.99)
  - 377 measurements w/ negative R_g



Science Plots

- Simple file structure for easy data manipulation
- I was able to easily make plots showing Afρ as a function of heliocentric distance



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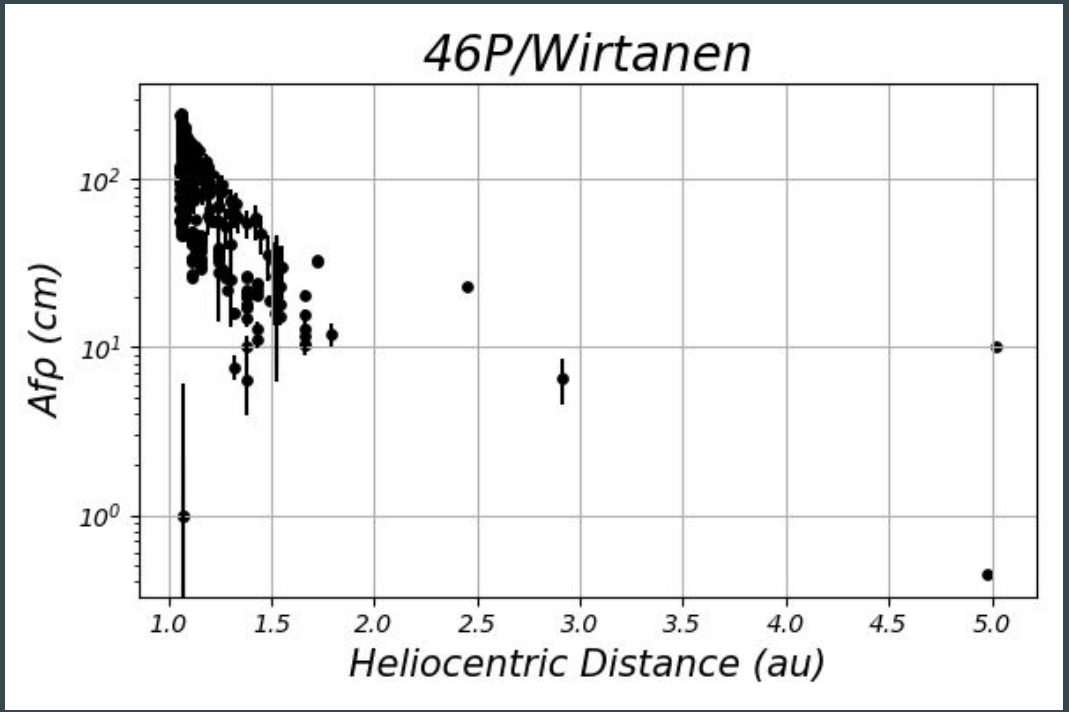
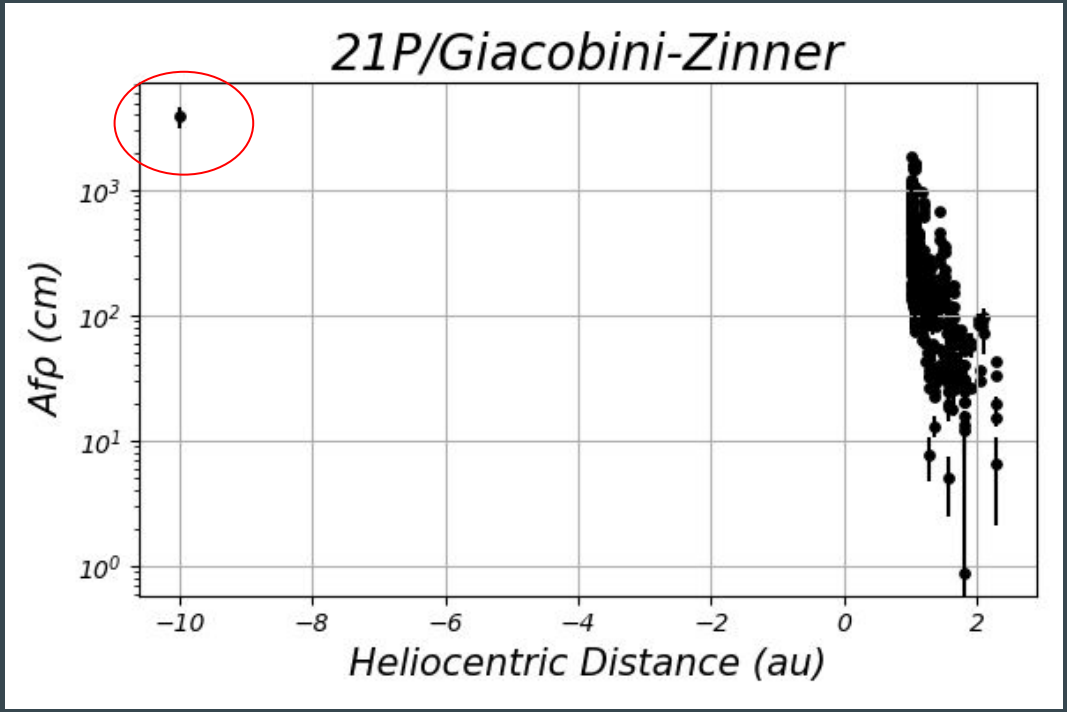


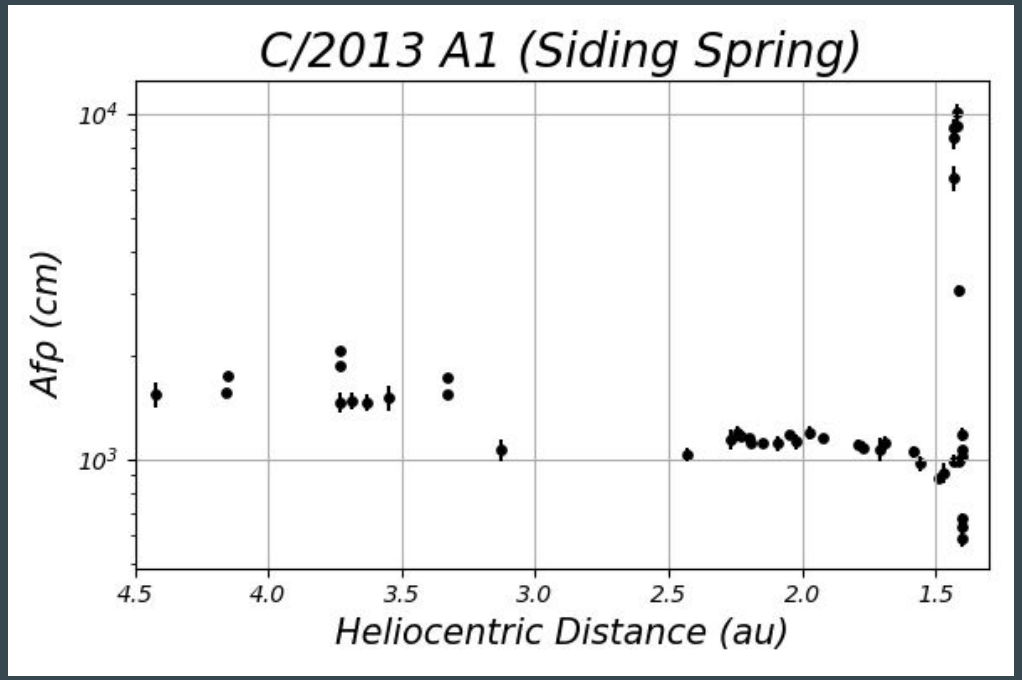
Science Plots

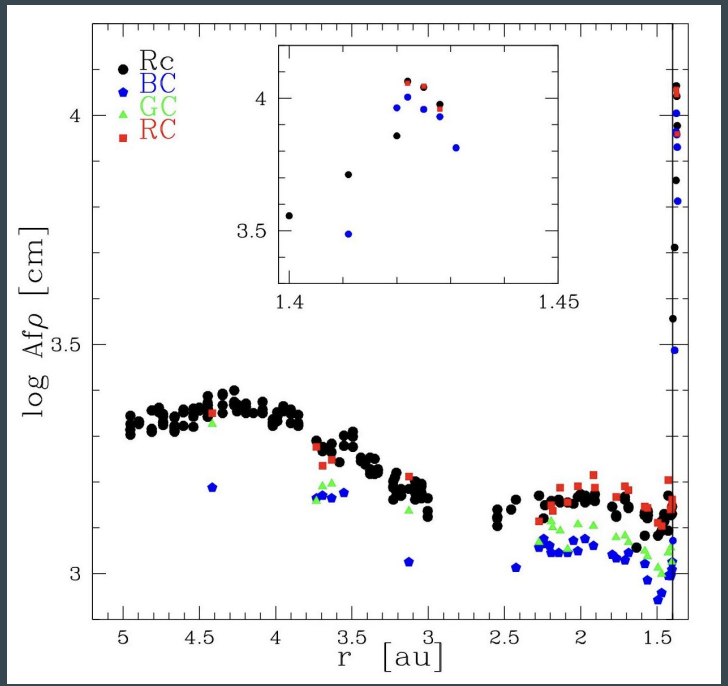
- Simple file structure for easy data manipulation
- Some negative values for reasonable Afρ data
  - I.e. 21P, -9.9 heliocentric distance?
    - 55 measurements w/ negative R_H



Science Plots- Spot Check to Literature

Opitom et al. 2016





Data w/ Negative Helio/Geocentric Distances

Label file says -9.99 indicates “missing_constant” → why ingest data without key geometry?

189 unique comets (377 total) w/ negative geocentric distances, with some name duplicates, e.g.:

- `'9P/Tempel-1' '9P/Tempel 1'`

28 unique comets w/ negative heliocentric distances → 55 total observations

Why a factor of 2?

All comets w/ negative heliocentric distances also have negative geocentric distances, but the inverse is not true.

Possible input error? It would surprising if these values were truly not known for Afρ measurements, and spot checks on the referenced publications shows no unknowns.

Liens

- Minor
  - Negative geometry not well described in overview.txt
    - E.g. -9999.99, -99.99, -9.99
    - Error codes need better explanation - why ingest Afrhos without corresponding geometry?
  - Possible consolidation of bandpass names (R vs R band vs. R-Band, etc)
- Major
  - Provenance of negative heliocentric/geocentric distances (189 comets) suggests potential broader collation/ingestion error