Hands-on Gaia

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Gaia-DPAC-CU8-Lead 'Astrophysical Parameters'

Airbus Space

Outline

- Useful resources
- Different ways to access Gaia data gea.esac.esa.int
- Basic queries on single and multiple tables
- Topcat
- Visualizing spectra
- Programmatic access

Useful resources

- Great resource: https://ees2023.sciencesconf.org/?lang=fr (look for the course notes and practicals)
- Gaia Help: https://www.cosmos.esa.int/web/gaia-users/archive
- Topcat: https://www.star.bris.ac.uk/~mbt/topcat/#install (note for internal STScI users with mac, do not use the dmg version, unless you have admin access, use 'curl…'

Accessing gaia data

- Gaia archive
  - Single object
  - Visualization
  - Help / Home
- Search:
  - Basic - selection of tables / fields / download results / show adql query
  - Advanced - TAP tables / Gaia tables / simple query / accessing results / download results / log-on
- CDS / Vizier (ari heidelberg …)
- Topcat

Basic queries on single and multiple tables

- Construct a colour-magnitude diagram using gaia_source
- Plot the HR diagram from the golden sample
- Search for the lowest / highest teff of UCD stars
- Select a random sample of these stars and compare the teff from gspphot
- Find astrophysical parameters and positions, parallaxes, for a list of stars in a user table

Basic queries on single and multiple tables

- Construct a colour-magnitude diagram using gaia_source, make a HR diagram using the gold sample table

```
select bp_rp, phot_g_mean_mag, parallax  from gaiadr3.gaia_source
where parallax_over_error > 30  and phot_g_mean_mag < 14

select top 10000 lum_flame,teff_gspphot, age_flame, mass_flame
from gaiadr3.gold_sample_fgkm_stars
```

- Search for the lowest / highest teff of UCD stars

```
select top 10 source_id, teff_espucd, teff_gspphot, libname_gspphot
from gaiadr3.astrophysical_parameters
where teff_espucd is not null  order by teff_espucd DESC
```

- Select a random sample of these stars

```
select ap.source_id, teff_espucd, ap.teff_gspphot, ap.libname_gspphot
from gaiadr3.astrophysical_parameters as ap
inner join gaiadr3.gaia_source as gs on gs.source_id = ap.source_id
where teff_espucd is not null
AND random_index  < 1000000
```

- Use external table

```
select ap.source_id, teff_gspspec, ap.teff_gspphot, lum_flame, mass_flame, radius_flame, ap.logg_gspphot,
mh_gspspec, parallax, phot_g_mean_mag, bp_rp, ap.ebpminrp_gspphot, ap.distance_gspphot, ra, dec, l, b
from gaiadr3.astrophysical_parameters as ap
inner join user_ocreevey.ngc2477 as xt on xt.source_id = ap.source_id
inner join gaiadr3.gaia_source as gs on gs.source_id = ap.source_id
```

Topcat

- Visualize the datasets
- Make queries on the gaia archive
- Cross-match with SIMBAD to get various identifiers and magnitudes

Visualizing spectra

- Using topcat and RVS spectra
- Using GaiaXPy for XP spectra with python

Programmatic access

- Notebook here: https://cloud.oca.eu/index.php/s/PsGA7oJYCf8dkNs
- Log-in
- Make a query (open cluster)
- Plot datasets
- Parallax bias