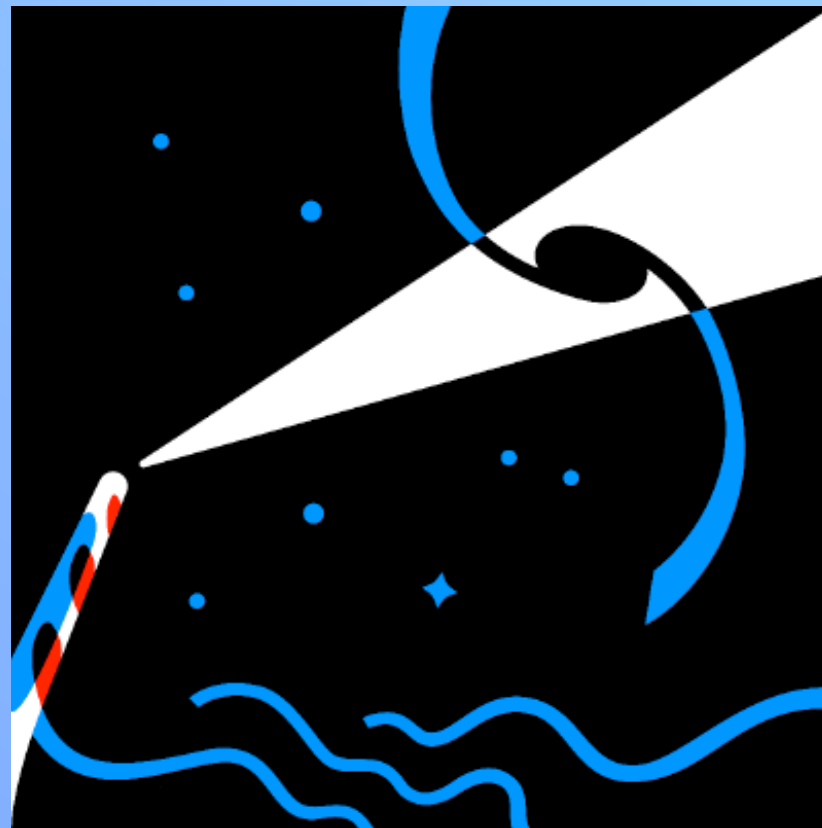


PHotometric Analysis for Redshift Estimation

(Arnouts S. & Ilbert O.)

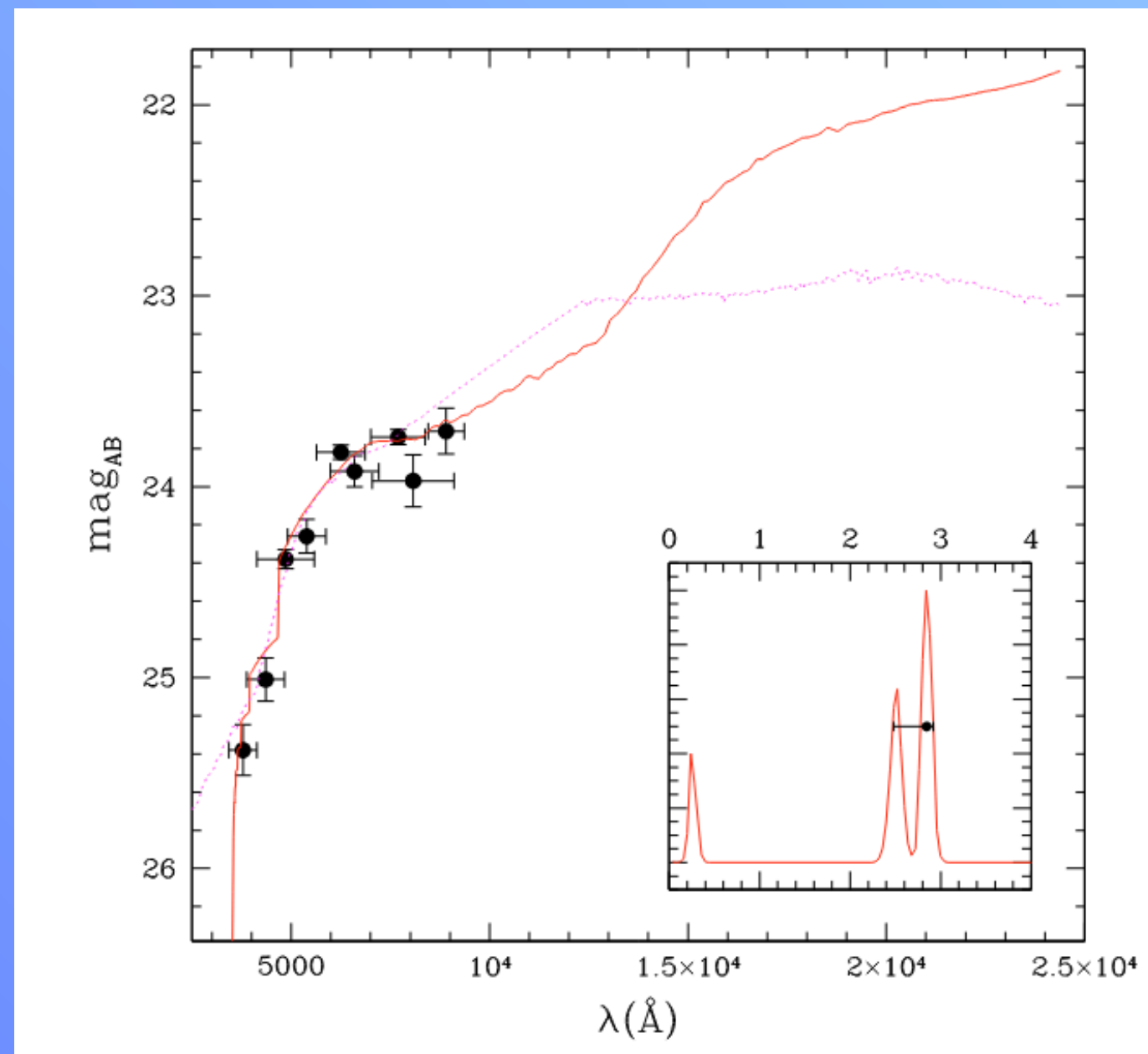


Patricia Fort – Python Meetings @ PUC

14/11/2025

What is LePHARE?

LePHARE has been a code for computing photometric redshifts and physical parameters by fitting spectral energy distributions (SED) to a dataset of photometric fluxes or apparent magnitudes.



It's a "template-fitting" code.

Installation

It's very easy: `pip install lephare`

Also to avoid any conflict, make an environment!

They recommend using Python 3.12

```
conda create -n <env_name> python=3.12
```

```
conda activate <env_name>
```



Website Gazpar

This is very useful if you don't need the results ASAP or don't have time to run your code!

GAZPAR News Getting started Documentati

DASHBOARD MENU

- My Data
- Filters
- Catalogues
- Requests
- Change password
- Logout

Dashboard Home

Welcome on your individual area

This is your personal dashboard on GAZPAR. From here, you can upload your own catalogues and request that some analysis is performed on them with our tools.

To compare simulated spectra to photometric observations, our tools need the filter transmission profiles associated to each photometric band; we provide a lot of filters but you can upload your own if needed.

Using the links in the left menu, you can:

- **Filters**
 - Browse the filters that are directly available on GAZPAR.
 - Upload your own filter transmission profiles.
- **Catalogues**
 - Upload your own multi-wavelength catalogues.
 - Associate each column to the corresponding filter.
- **Requests**
 - You can request an analysis using one of our tool:
 - **LPZ**: photometric redshift estimation using Le Phare
 - **LPP**: physical parameter estimation using Le Phare
 - **CI**: physical parameter estimation using CIGALE
 - **HZ**: photometric redshift and physical parameter estimation using HyperZ
 - **BG**: physical parameter estimation using BEAGLE

Hot news!

Since June 2022, when you submit a request, an automatic run may be executed and you will be able to download preliminary results while waiting for the expert astronomer answer. At the beginning only *Le Phare* analyses are automatically ran, we will add more tools later.

Since April 27th 2022, we are using the new version of **Le Phare** rewritten in C++. Also, we are now asking for the reference band to use in our diagnostics.

Since June 2021, a new tool is available: **HyperZ**, see the [software](#) page.

De hecho

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Running with the command line

Preparation

- 1. Build the SED library

List of SED *filename* including path
GALAXY SEDs in \$LEPHAREDIR/SED/GAL/*filename*
QSO ... /QSO/ ...
STAR ... /STAR/ ...

Command line executables

sedtolib

SED library (binary format and doc)
Products stored in \$LEPHAREWORK/lib_bin

- 2. Build the filter library

List of *filename* from FILTER_LIST including path
\$LEPHAREDIR/filt/*filename*

filter

Filter file (ascii format and doc)
Products stored in \$LEPHAREWORK/filt

- 3. Build the flux/magnitude library

Build from SED and filters libraries (step 1 & 2)
+ redshift grid, cosmology, dust, ...

mag_gal

Flux/magnitude library (binary format and doc)
Products stored in \$LEPHAREWORK/lib_mag

Photometric redshifts

Start with the flux/magnitude libraries (step 3)
+ input catalogue
+ list of output parameters

zphota

Output catalogues
Products stored in the working directory

Filters

Several sets of filters from different telescopes/instruments are available in the directory `$LEPHAREDIR/filt/`

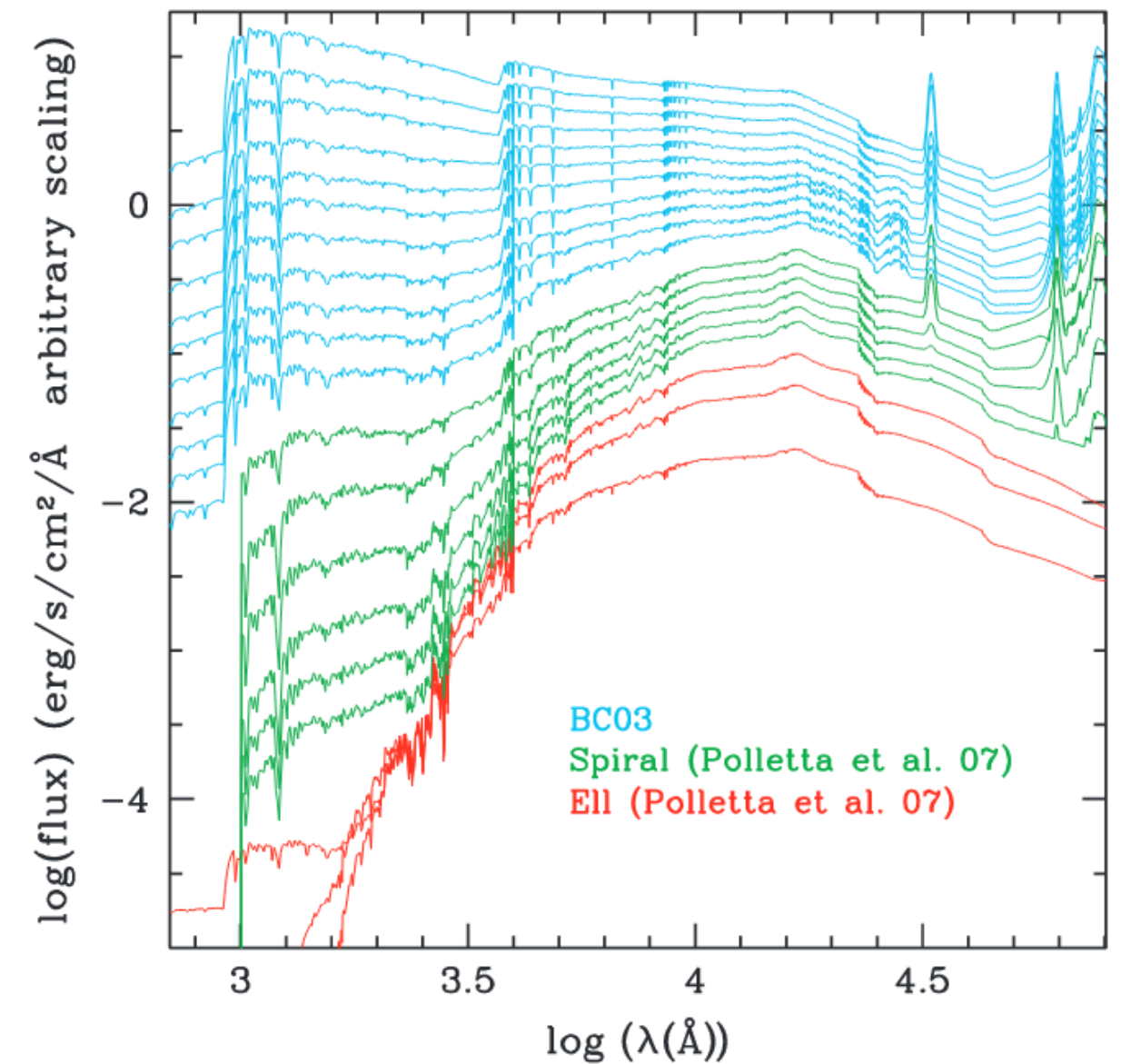
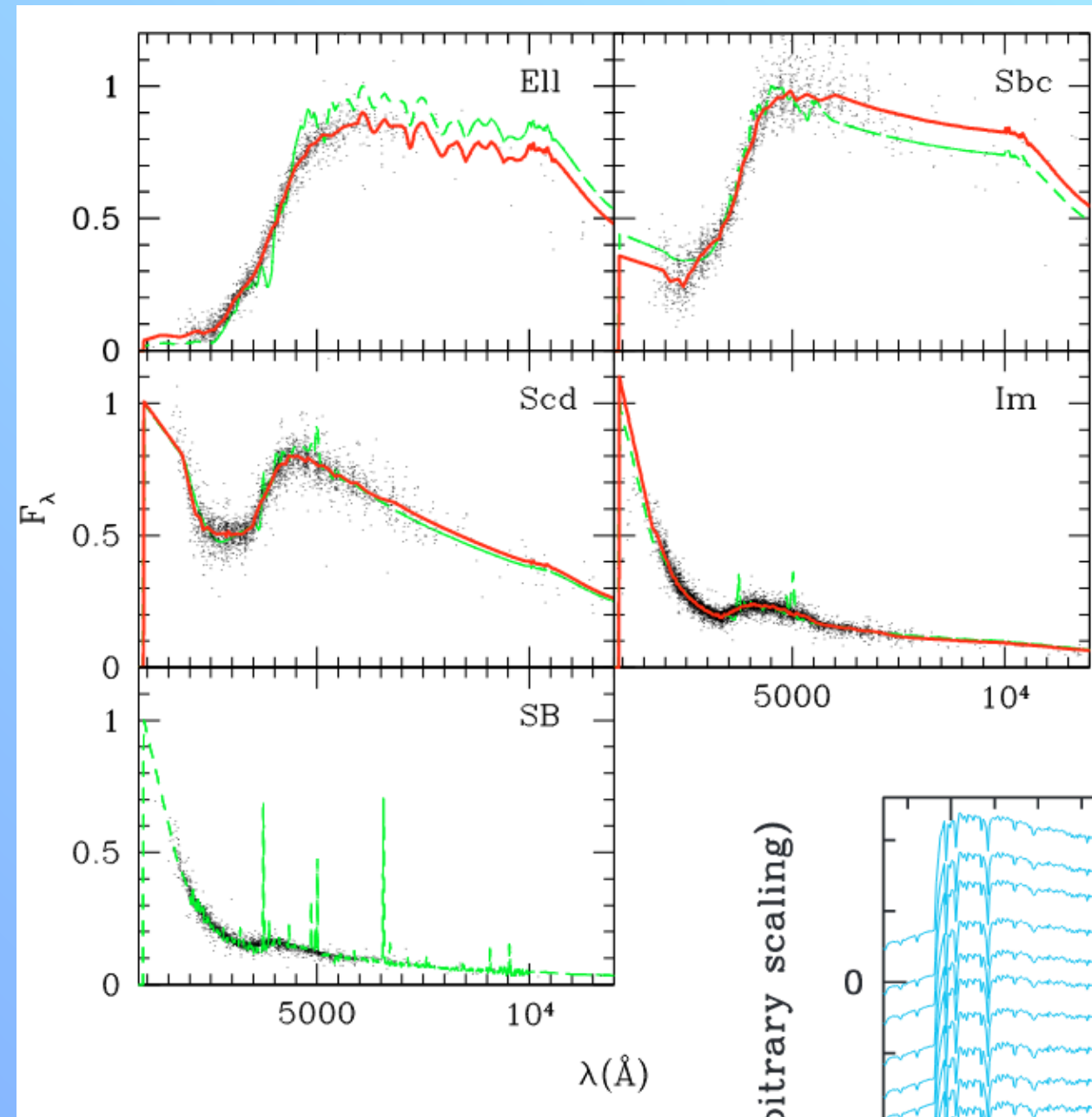
You could also store new filters in another directory than `$LEPHAREDIR/filt/` using the keyword `FILTER_REP`.

```
# decam_I
# photon
# calib 0
# i from DECam at CTIO/Blanco (http://www.ctio.noao.edu/noao/node/1033)
6820 0.00000
6830 0.00106
6840 0.00117
6850 0.00133
6860 0.00148
6870 0.00145
6880 0.00170
6890 0.00250
6900 0.00233
6910 0.00273
6920 0.00312
6930 0.00379
6940 0.00443
6950 0.00577
6960 0.00711
6970 0.01045
6980 0.01363
6990 0.04628
7000 0.03292
7010 0.04638
7020 0.06010
7030 0.08735
7040 0.11407
7050 0.15083
7060 0.18851
7070 0.23260
7080 0.27654
7090 0.35156
7100 0.35919
```

SEDs

There are a bunch of SED already added to LePHARE, for GALAXY, QSO or STAR.

Use the one that is more aligned with your work. Or add your own here: [\\$LEPHAREDIR/sed/](http://LEPHAREDIR/sed/)



The Configuration file

The best way to run LePHARE is having a “params.para” file, where we will store our list of keywords.

Here is an example: <https://github.com/lephare-photoz/lephare-data/blob/main/examples/COSMOS.para>

Here is a list with all the keywords.

The Configuration file

Some parameters are mandatory. LePHARE will print out an error message if they are not set.

Other parameters can be omitted (LePHARE will assign a default value to them).

Another parameter file, `output.para` includes all the possible output parameters. You can comment those that are of not interesting to you.

The Catalog

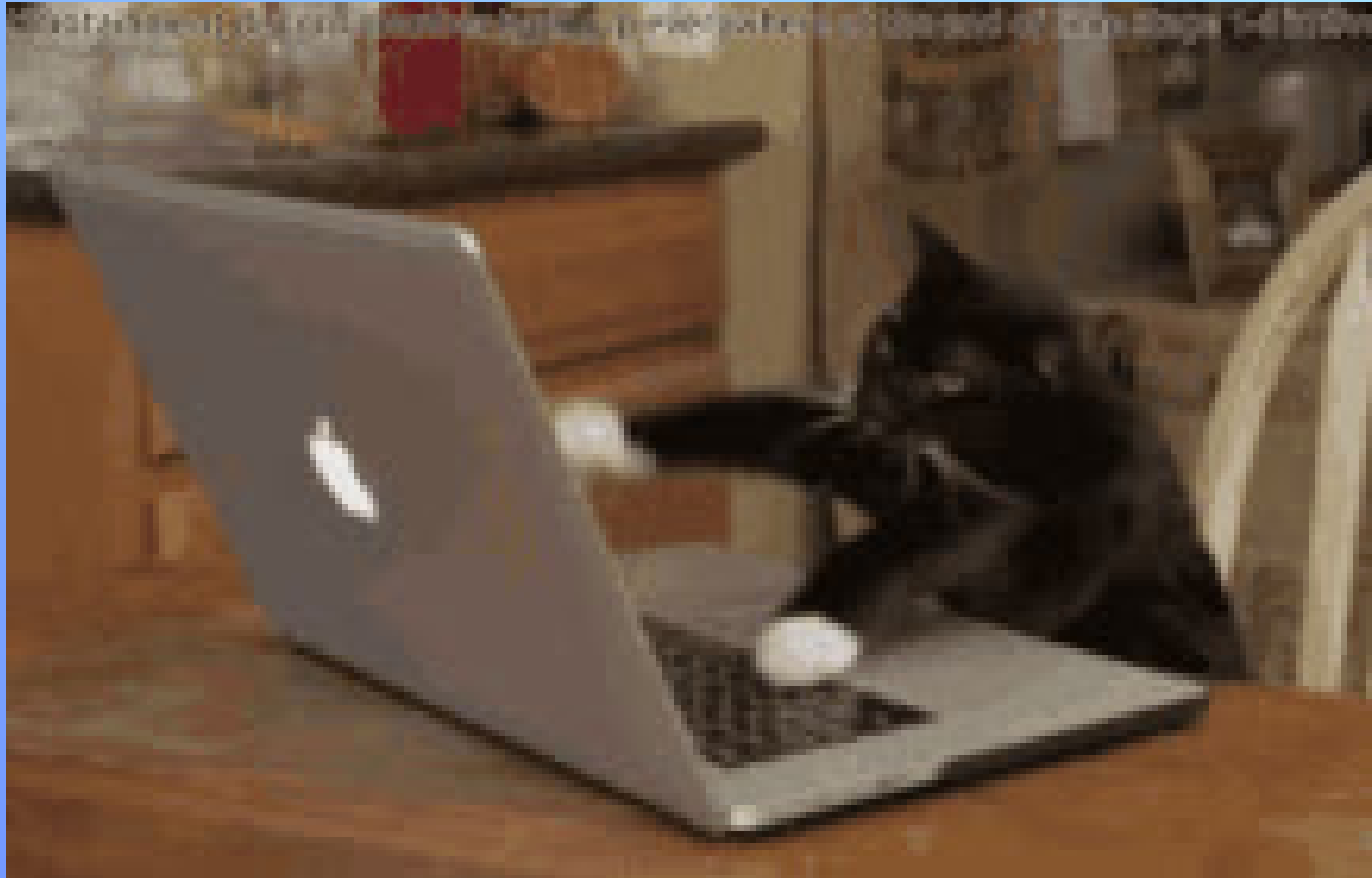
The program expects an ascii file in input when using command lines. CAT_IN specifies the location and name of the input file.

The format of the input catalogue is specified by CAT_FMT, whose value must be set to MEME (**“Magnitude-Error-Magnitude-Error”**), or the string MMEE (**“Magnitude...Magnitude-Error...Error”**)

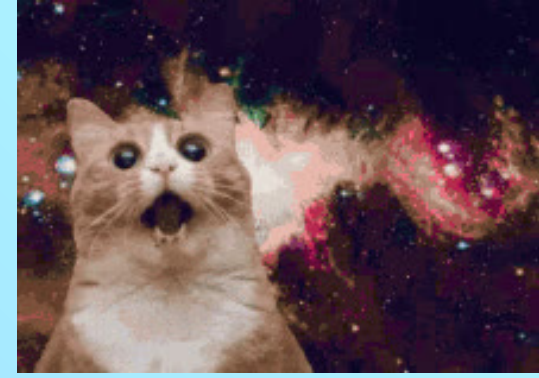
Other columns may follow the photometric baseline when the option CAT_TYPE is set to LONG (it is SHORT by default). Such extended catalog will look like:

```
Id mag1 err1 mag2 err2 ... magN errN Context z_spec Extra1 Extra2...
```

Let's code!



Takeaways



- **Flexible & Robust:** A well-tested code that can be run from the command line (for batch processing) or integrated into scripts and notebooks.
- **Computationally Efficient:** Optimized for speed, making it a powerful tool for processing the massive datasets from large-scale surveys.
- **Provides Rich Outputs:** LePHARE delivers more than just a single redshift (z_{best}). It provides:
 - **Full Redshift PDFs:** The complete probability distribution, crucial for understanding uncertainties.
 - **Physical Parameter Estimation:** Derives key properties like stellar mass (M_*), age, and star formation rate (SFR) from the best-fit SED.