Activité photo-z à l'APC : le code de calcul Le PHARE

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Plan

Le PHARE: simulation

Steps:

1. Templates of Galaxy SED
2. Filters
3. Extinction

   ➡ Computation of Magnitude and k-correction: Template fitting + redshifting + integration through T_{filter} + extinction
4. Spatial distribution of Galaxies with LF
5. Detection threshold (5σ depth)

➡ **Mock catalogue of Galaxies**:

- simulated redshift z_{ref}
- apparent magnitude $m(filter)$ and error $\sigma_m(filter)$)

Le PHARE: reconstruction

Steps:

1. Templates of object SED (Galaxy, QSO, Star)
2. Filters
3. Extinction
   ➡ Computation of Magnitude and k-correction
4. Photometric errors
5. χ^2 fitting on the modeled fluxes and the observed fluxes

➡ **Reconstruction of photo-z**:

- photometric redshift z_{photo}
- posterior probability distribution function pdf(z_{photo})

Le PHARE: evolution

- Computing constraints of Le PHARE:
  - Fortran 77
  - Huge code: $\sim$27 000 lines just for source files
  - Strong limit on the library size
  - Computing time can be huge: $\sim$30 min for $\sim$40 000 objects ➟ 500 days for 10^9 objects (with few SEDs).
- **Pyraeus** project: Le PHARE v2.0
  ➟ rewriting of the code in Python

SED

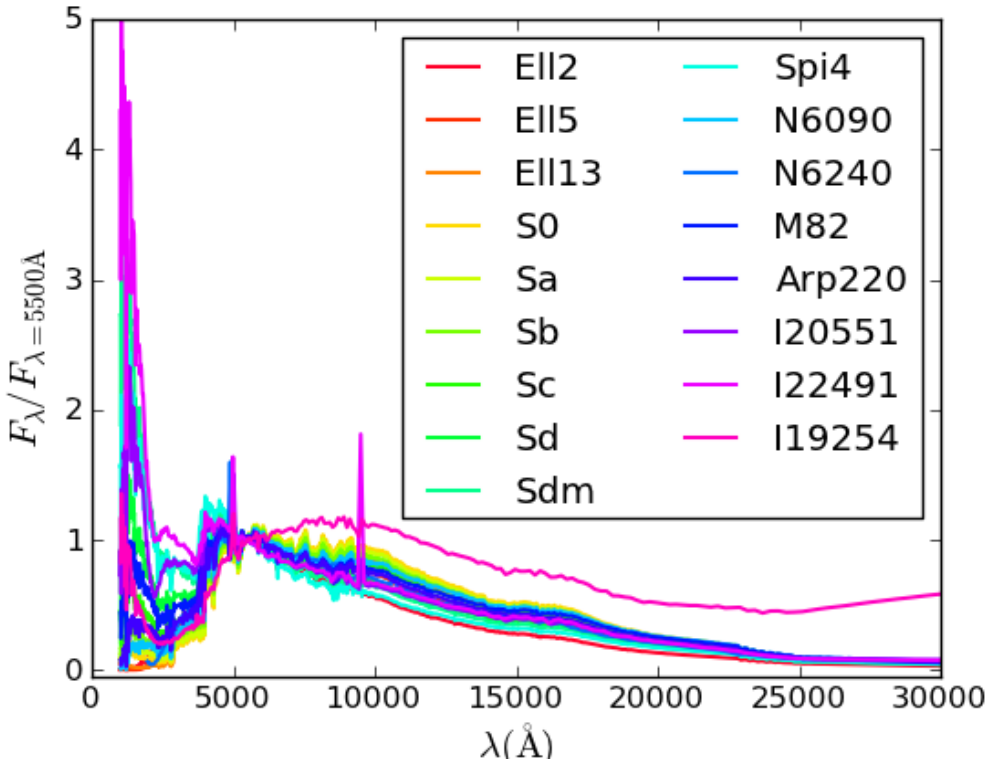


Figure: Polletta (normalized flux): 25 templates including 3 Ellipticals, 7 Spirals, 6 Starbursts, 7 AGNs (3 type 1 AGNs, 4 type 2 AGNs), and 2 composites (Starburst + AGN).

Filters

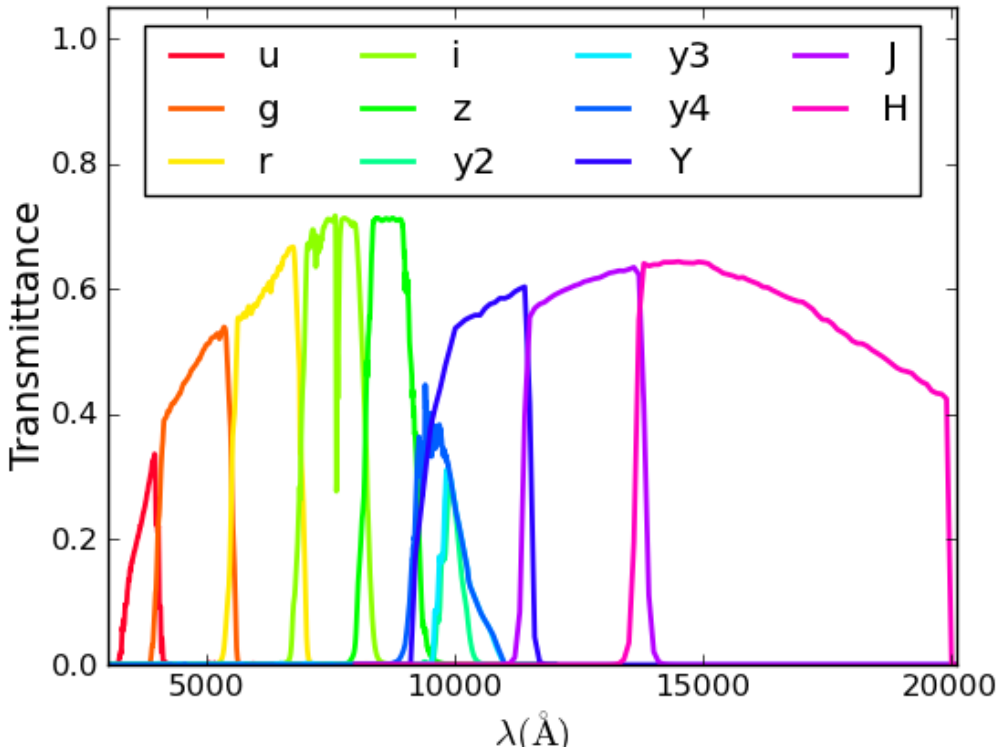


Figure: LSST: u,g,r,i,z,y; Euclid: Y,J,H (filter transmission with the quantum efficiency of the CCD, the mean atmospheric transmission, the filter transmission, and the telescope optical throughput).

Extinction

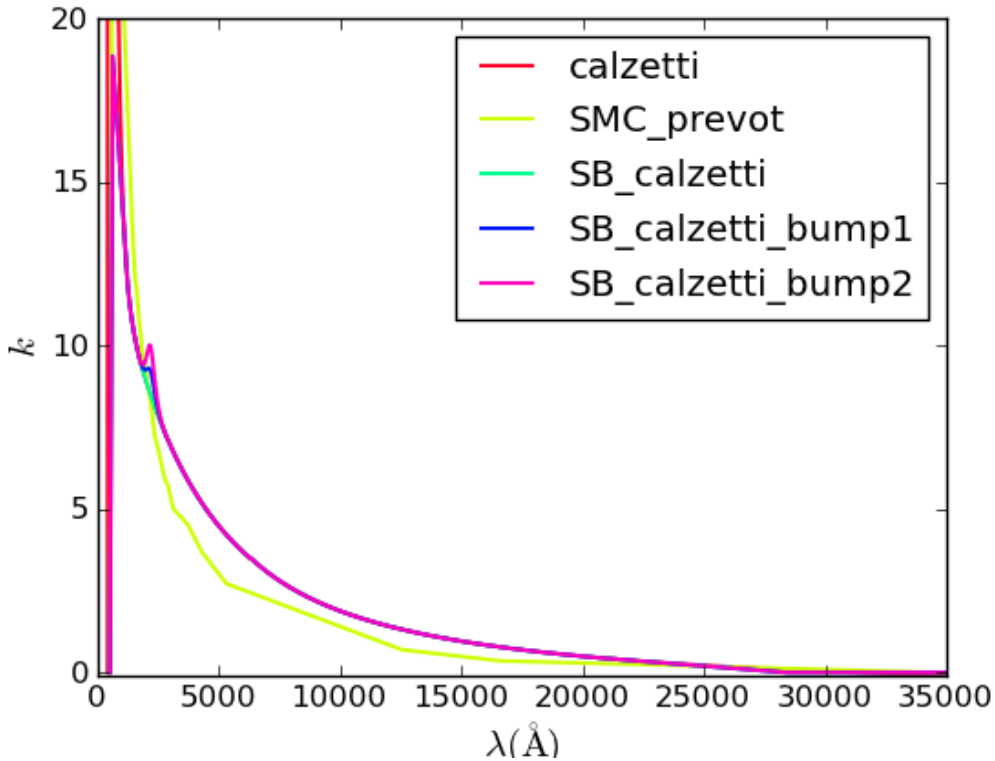


Figure: Extinction laws: Calzetti, modified Calzetti and Prevot (Small Magellanic Cloud).

Luminosity function

- Schechter function
- ESS (ESO-Sculptor Survey)
  - R band of Vega system
  - Area: $\Omega \sim 0.4$ deg^2

LF class	Type Range	z range	ϕ_*	α	R_*	$\phi_{ev}(z)$	$M_{ev}(z)$
Early	1 – –18	$0 \leq z \leq 6$	$14.77\text{x}10^{-3}$	0.11	-20.56	1	0
Spiral	16 – –42	$0 < z < 6$	$13.54\text{x}10^{-3}$	-0.73	-20.43	1	0
Late/Irr	36 – –55	$0 \leq z \leq 0.15$	$6.06\text{x}10^{-3}$	-1.63	-19.84	1	0
Late/Irr	40 – –57	$0.15 < z \leq 0.7$	$6.06\text{x}10^{-3}$	-1.63	-19.84	$(1+(z-0.15)x3.69)$	0
Late/Irr	40 – –57	$0.7 < z \leq 1.25$	$16.12\text{x}10^{-3}$	-1.63	-19.84	1	0
Late/Irr	40 – –59	$1.25 < z \leq 2.5$	$16.12\text{x}10^{-3}$	-1.63	-19.84	1	$-0.12*(z-1)$
Irr	42 – –62	$2.5 < z \leq 3.5$	$1.6\text{x}10^{-2}$	-1.63	-19.84	1	$-0.22*(z-1)$
Irr	42 – –62	$3,5 < z \leq 6$	$1.6\text{x}10^{-2}$	-1.63	-19.84	1	$-0,12*(z-1)$

Figure: Schechter parameters for ESS LF [Arnouts & Ilbert: simulation document]

Luminosity function

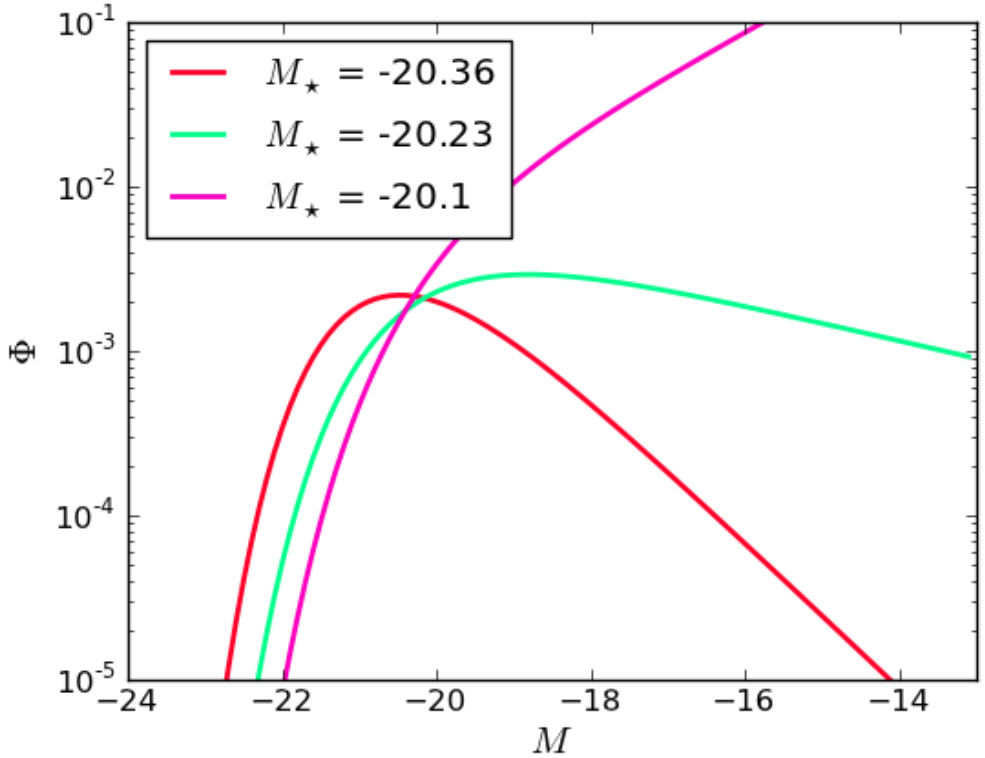


Figure: Schechter function for ESS LF

Model in few words

Simulation:

- Polletta SED (3 Ellipticals, 7 Spirals, 3 Starbursts)
- 6 LSST filters (y3 filter) + 3 Euclid filters
- Extinction laws by Calzetti: applied only on Spirals (S0 - Sd) and with a color excess $E(B-V) = 0$; 0.05; 0.1; 0.2; 0.3.
- $z = [0-6]$ and $m = [18-26]$
- LF: ESO-Sculptor Survey (ESS)
- Simulated area: $\Omega = 0.5$ deg^2
- LSST limiting apparent magnitude: 1 year of Science Book (09)

Model in few words

Catalogue:

- Original error: $\sigma_m(\mathit{filter}) \simeq 0.2\%\ m(\mathit{filter})$

Reconstruction:

- Only Galaxy SED (Polletta)
- Same filters and extinction laws

➙ A total of 45,000 objects

Results

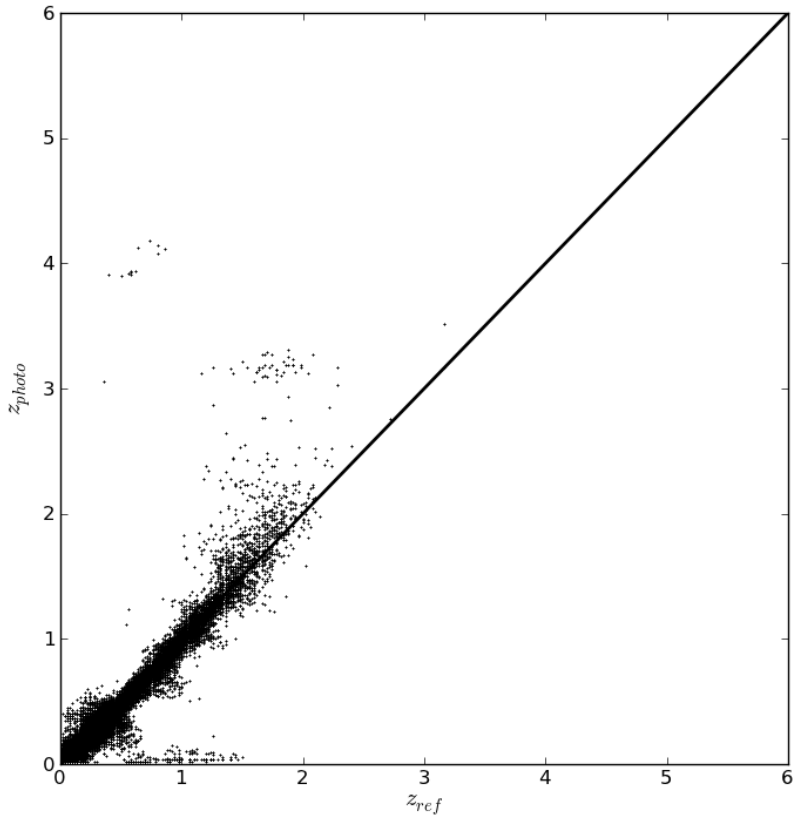
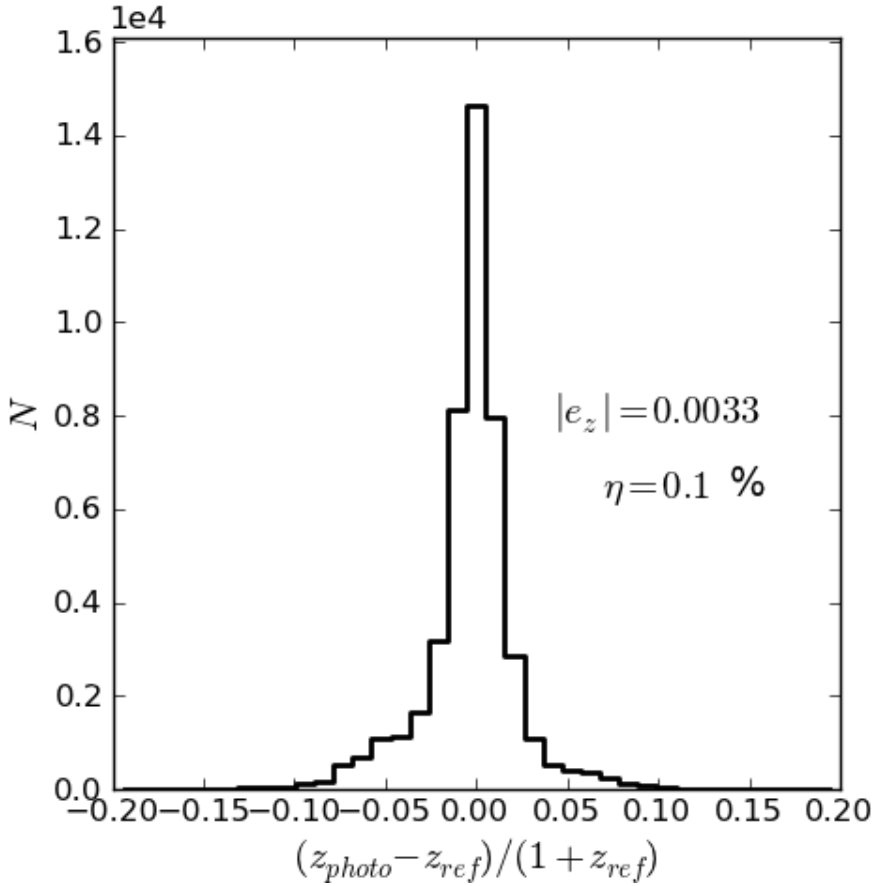


Figure: Polletta + ESS.

Results



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Results

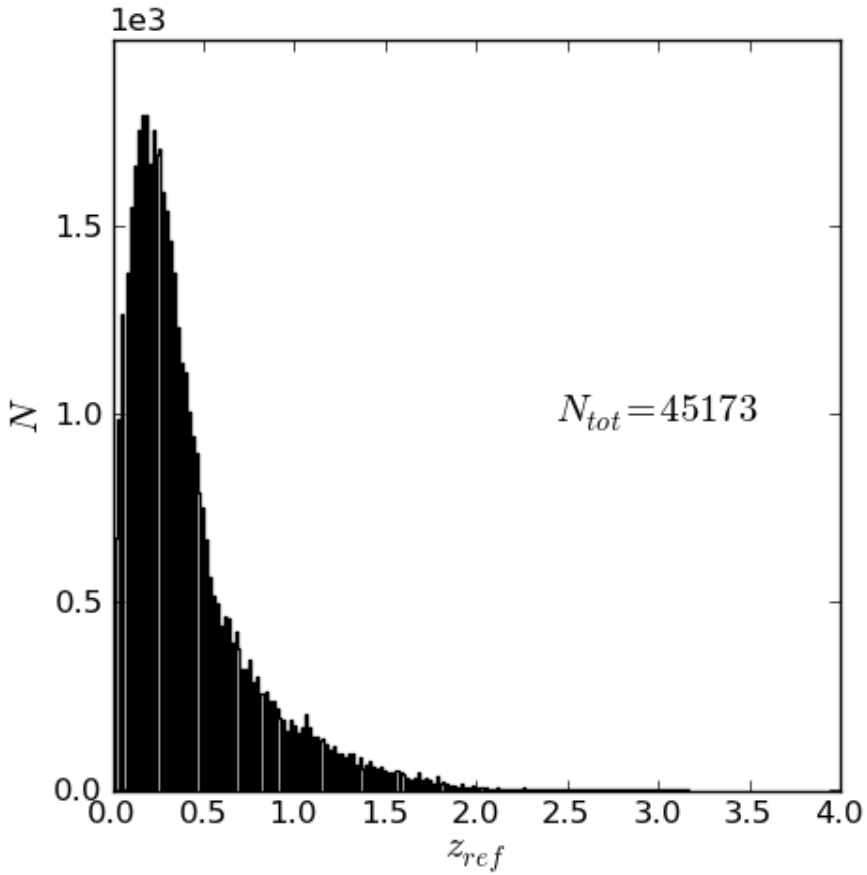

Figure: Polletta + ESS.