Photometric Redshifts for Dark Energy Experiments

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Collaborators

Photometric Redshifts

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Cluster counts

- Wayne Hu (University of Chicago)

Photo-z Motivations

- Dark Energy Survey (DES)
  - Cosmological probes: Weak Lensing
    Cluster Counts
    Supernova
    Baryon Acoustic Oscillations
  - All probes require well-calibrated redshifts.
  - Hard/expensive to get spectra (Spectroscopic redshifts) for millions of galaxies.
  - Solution: Photometric redshifts (photo-z's) with broadband photometry.

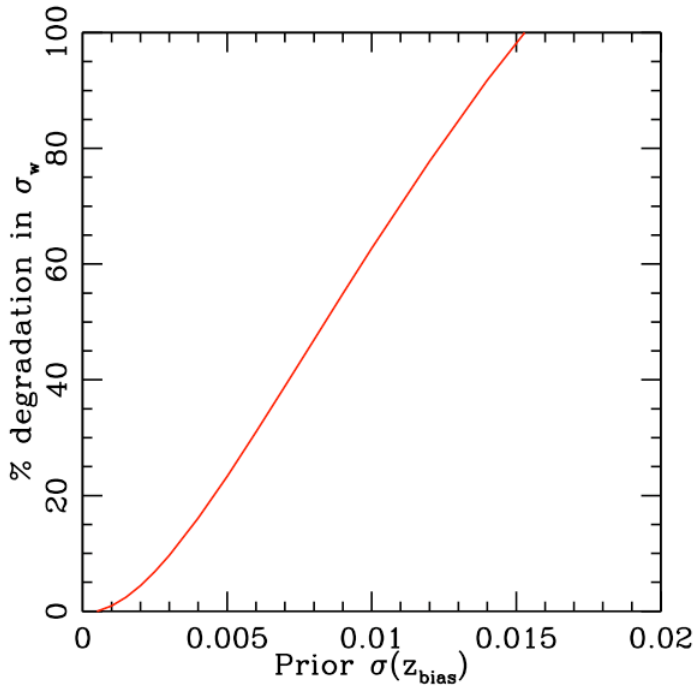
- South Pole Telescope (SPT)
  - Detect clusters using the SZ effect
  - Cluster photo-z's from DES

Cluster Counts DE Constraints: Redshift Requirements

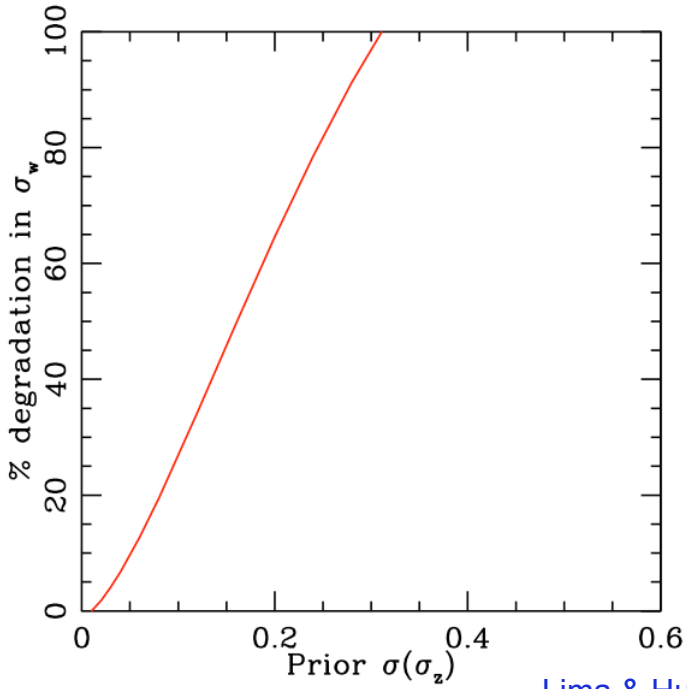
$$z_{bias} = \frac{1}{N}\sum_{i=1}^{N} z^i_{phot} - z^i_{true}$$

$$\sigma_z^2 = \frac{1}{N}\sum_{i=1}^{N}\left(z^i_{phot} - z^i_{true}\right)^2$$

Systematic errors



Random errors



Lima & Hu in prep.

Photo-z Methods

- Probe strong spectral features (4000 A break)
- Difference in flux through filters as the galaxy is redshifted.

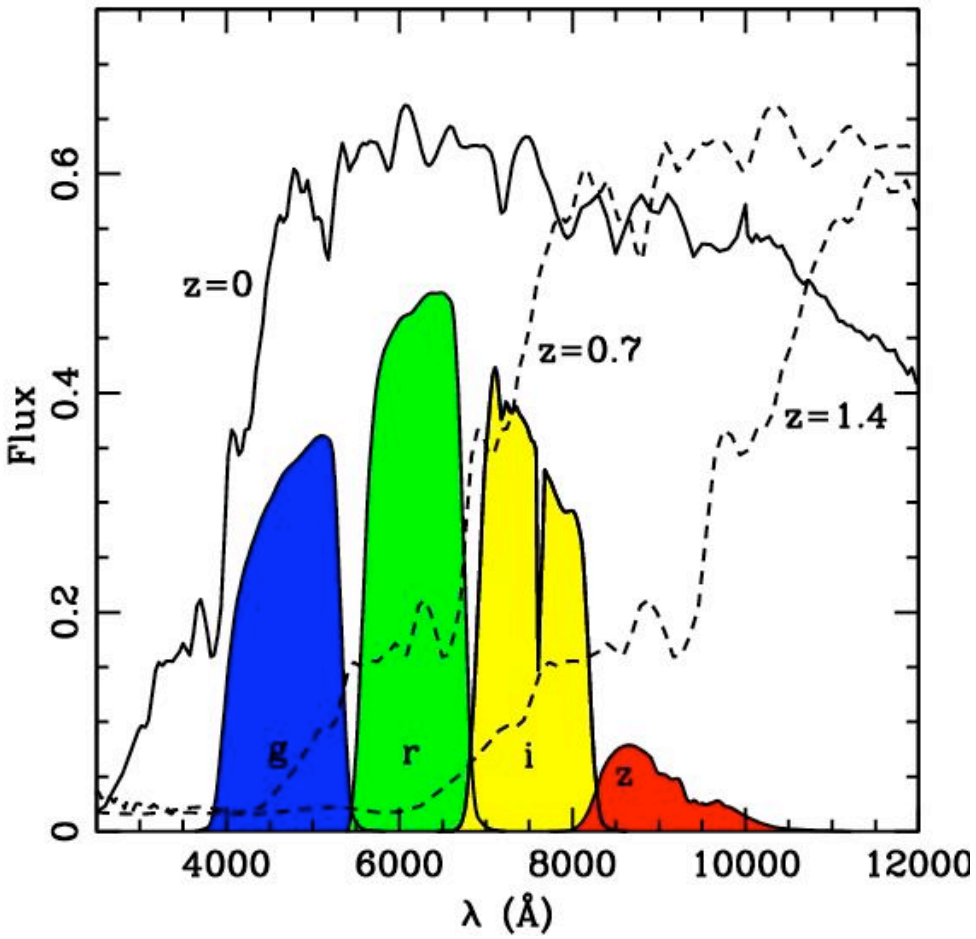


Photo-z Methods

- Template Fitting Methods
  - Use a set of standard SEDs (templates)
  - Calculate fluxes in filters of redshifted template
  - Match target object's fluxes (χ^2 minimization)
  - Outputs type and redshift

- Training Set Methods
  - Determine functional relation between m and z_{phot} using a training set

$$z_{phot} = z_{phot}(m, c)$$

DES Galaxy Photo-zs

Cunha et al in prep.

DES
griz filters

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}\left(z^i_{phot} - z^i_{spec}\right)^2$$

$\sigma_{68} = 68\%$ confidence region

Limiting Magnitudes

g	24.6
r	24.1
i	24.0
z	23.65

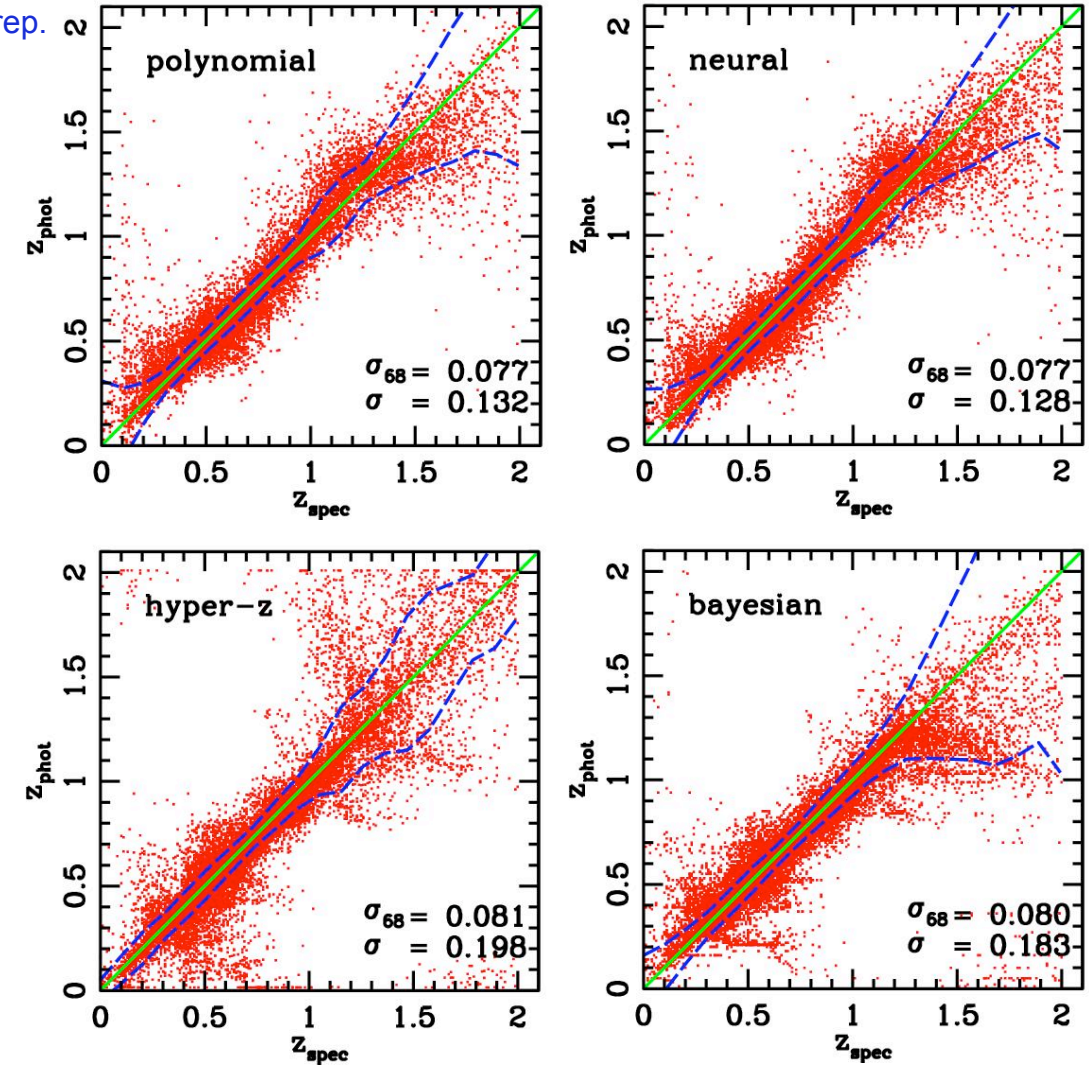


Photo-z Papers in prep.

- Paper 1 : Review/comparison/development of photo-z methods.
- Paper 2 : Development of robust photo-z error estimators.
- Paper 3 : SDSS DR5 photo-zs publicly available.
- Paper 4 : DES simulation photo-zs and forecasts.