SN Cosmology with BEAMS

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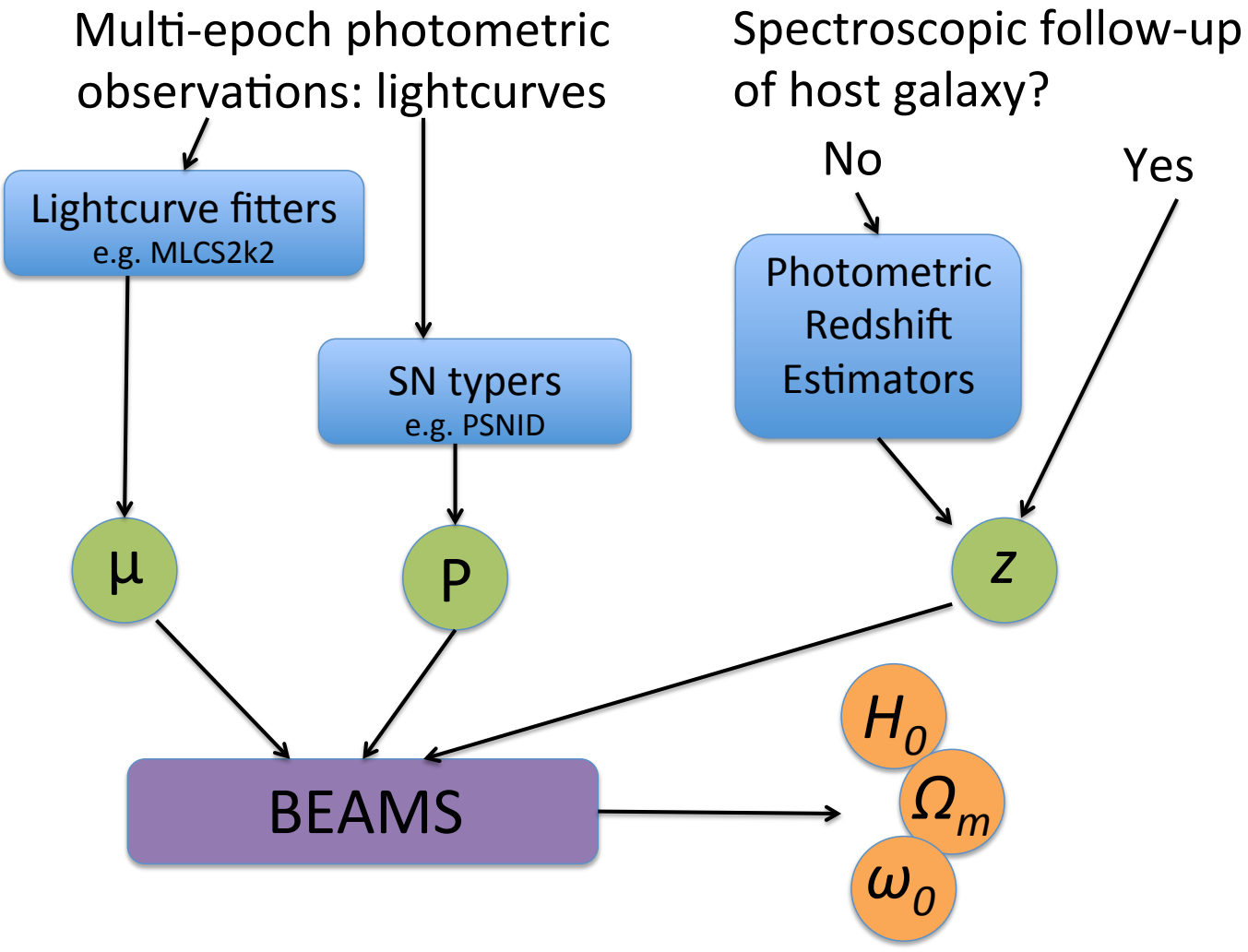
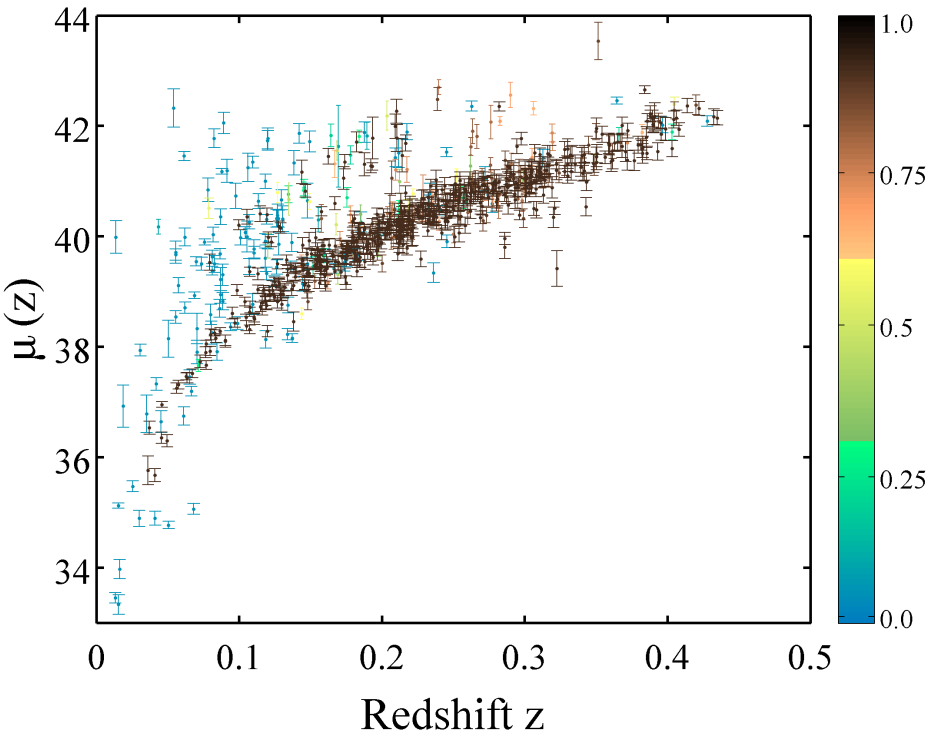
Motivation

- doing cosmology with SNe, without spectroscopy
- incorporate type probably
- use the full (contaminated) sample, without making cuts
- error ellipses on cosmological parameters

What does BEAMS do?



Photometric Sample from SDSS-II SN Survey



Hlozek et al. 2012

- z from host galaxy spectroscopic redshift
- μ from MLCS2k2 (Jha et al. 2007)
- color coded using P_{Ia} from the PSNID typer (Sako et al. 2008, 2011)
- we want to fit for two populations: SNIa and non-SNIa

Calculating the Posterior Probability

Maths:

$$P(\boldsymbol{\theta}|\boldsymbol{d}) \propto P(\boldsymbol{\theta}) \times$$
$$\prod_{i=1}^{N} \left\{ P(d_i|\boldsymbol{\theta}, \text{SN Ia}) P_{\text{Ia},i} + P(d_i|\boldsymbol{\theta}, \text{not SN Ia}) \left(1 - P_{\text{Ia},i}\right) \right\}$$

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- $\boldsymbol{d}$: μ, μ_{err}, z

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Words:

Posterior probability for total population $\propto$
prior on cosmological parameters $\times$
$\prod_{i=1}^{N}$ (likelihood for Ia $\times$ probability that it is a SN Ia
+ likelihood for not Ia $\times$ probability that it is not a SN Ia)

Calculating the Posterior Probability

$$P(d_i|\boldsymbol{\theta}, \text{SN Ia}):\ \boldsymbol{\theta} = H_0, \Omega_m, \Omega_\Lambda$$

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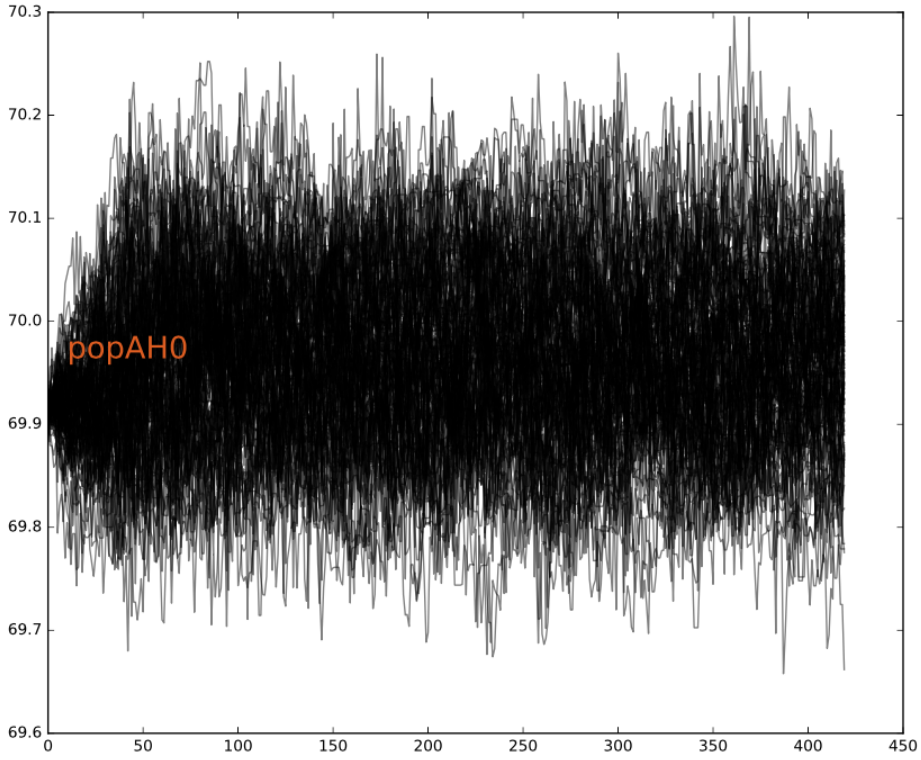
$P(d_i|\boldsymbol{\theta}, \text{SN Ia})$: $\boldsymbol{\theta} = H_0, \Omega_m, \Omega_\Lambda$
$P(d_i|\boldsymbol{\theta}, \text{not SN Ia})$:
fitting several sub-populations... do you need a single mean, binned means?

Maximizing the Posterior Probability



MCMC walkers.

- BEAMS is implemented using MCMC. (*emcee* Python package.)
- See Renee's talk yesterday.

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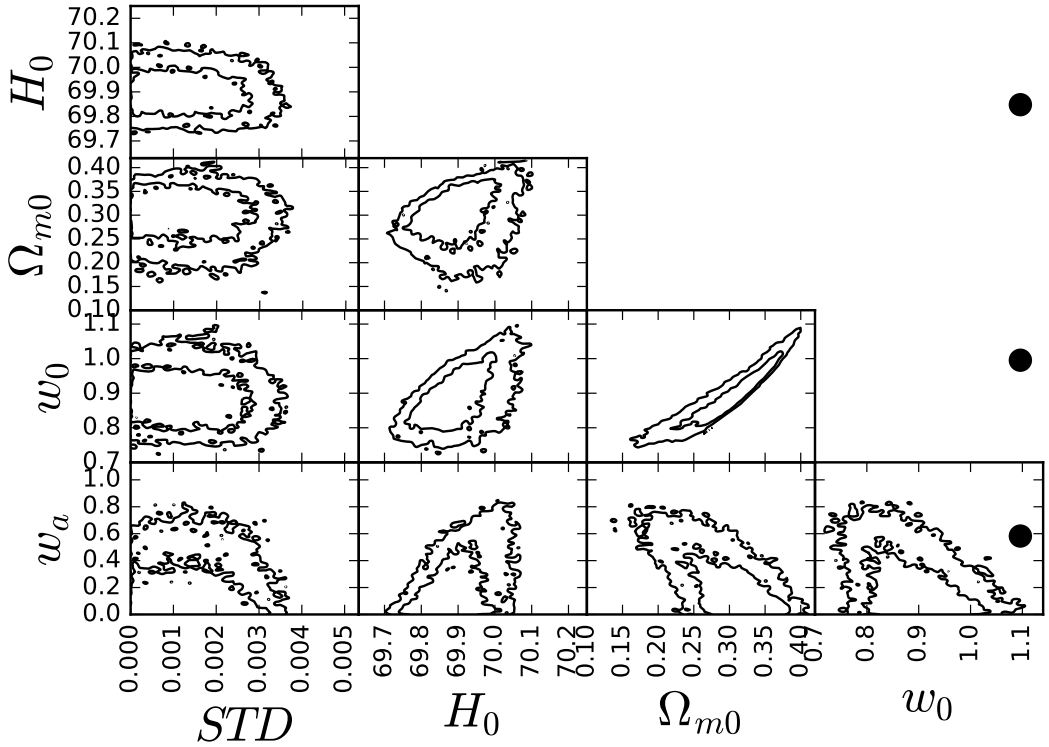

Covariance of cosmological parameters.

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- This gives full error ellipses on all the fit parameters.

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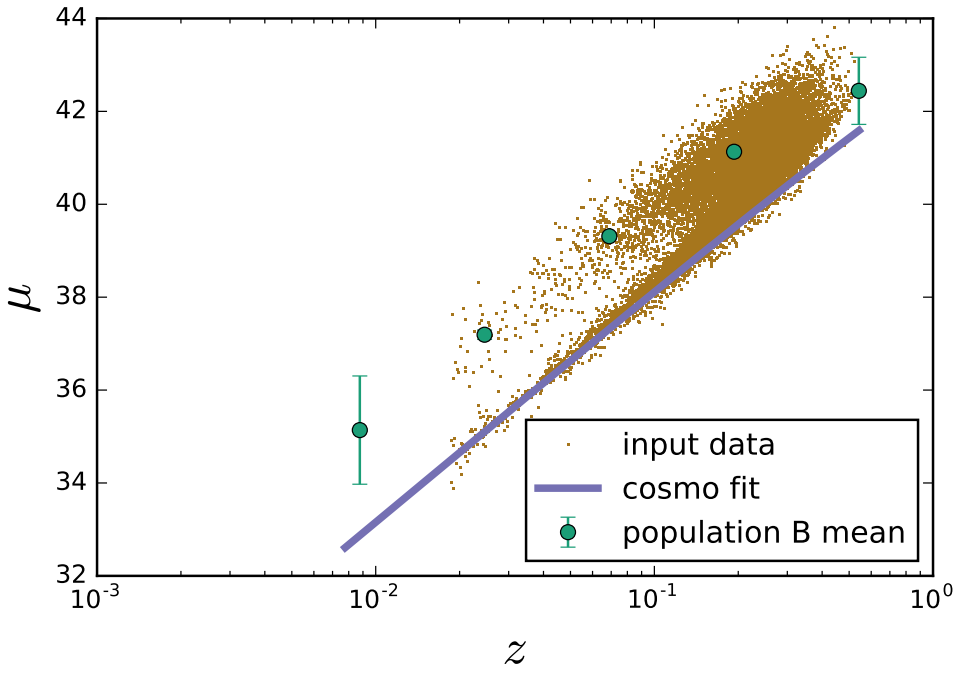

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Fits to mock SNe data.

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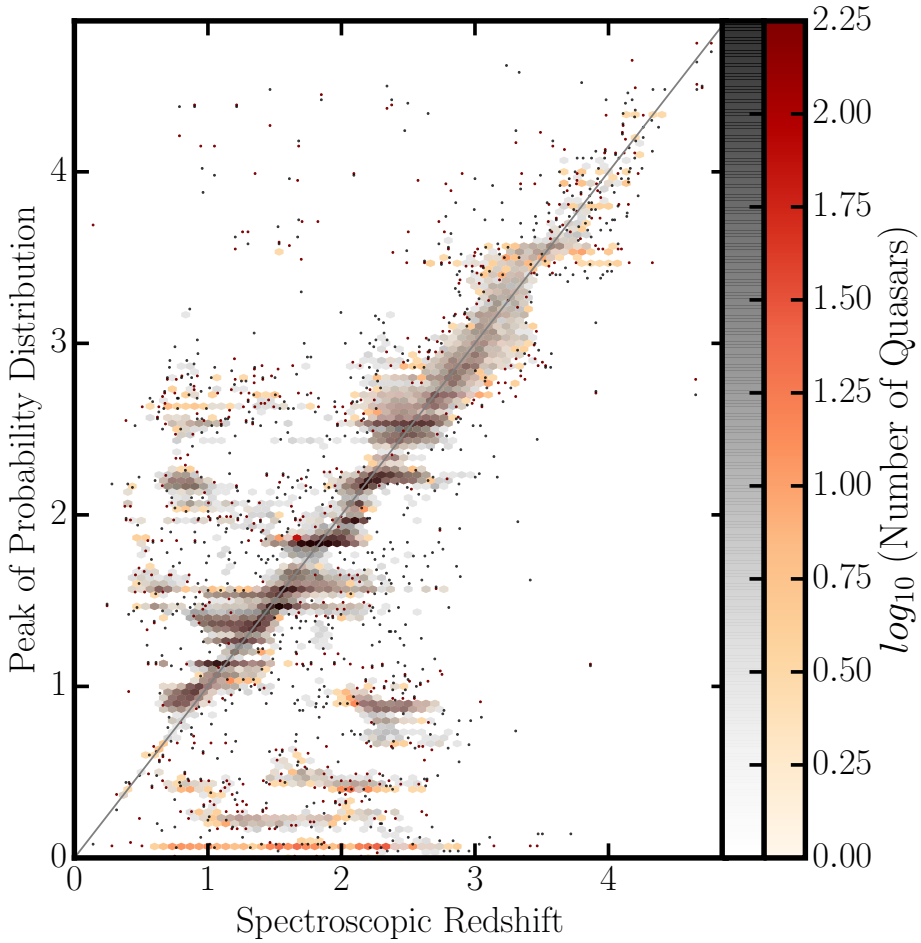
- Selection effects as priors? Magnitude, galaxy type, Malmquist bias, others?
- Flexible in the model for the non-Ia population.
- Comparison of lightcurve fitting algorithms, how does that effect the output cosmology?

More about Photo-z PDFs (of quasars...)



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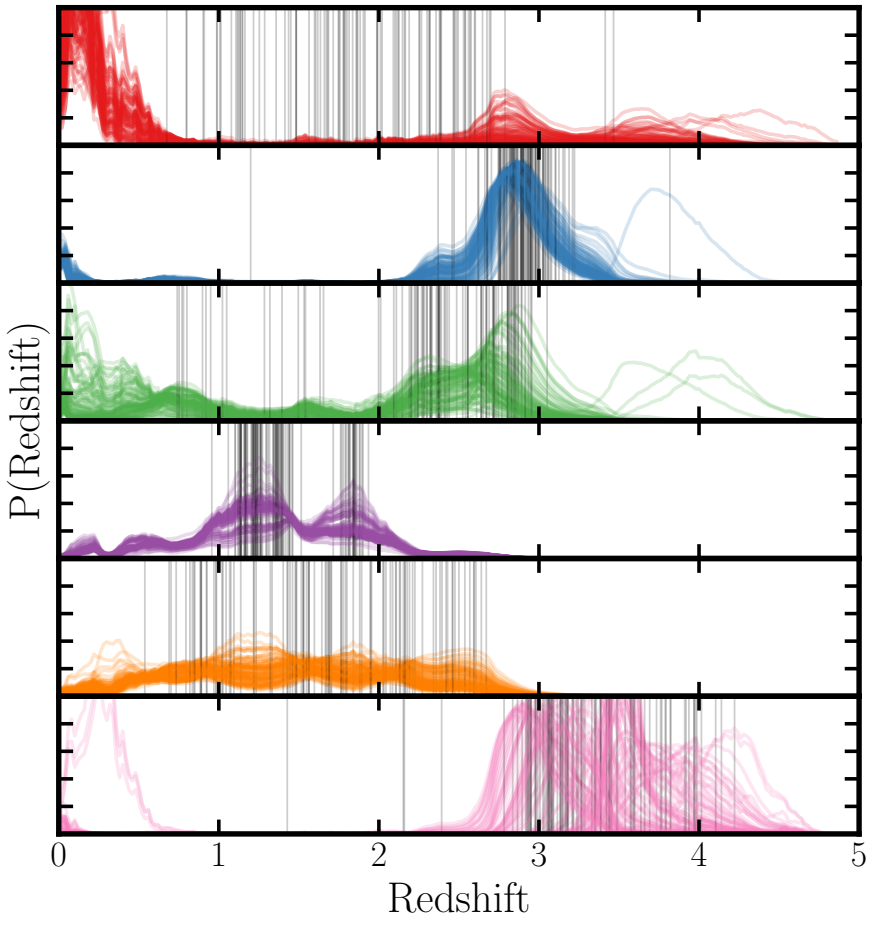

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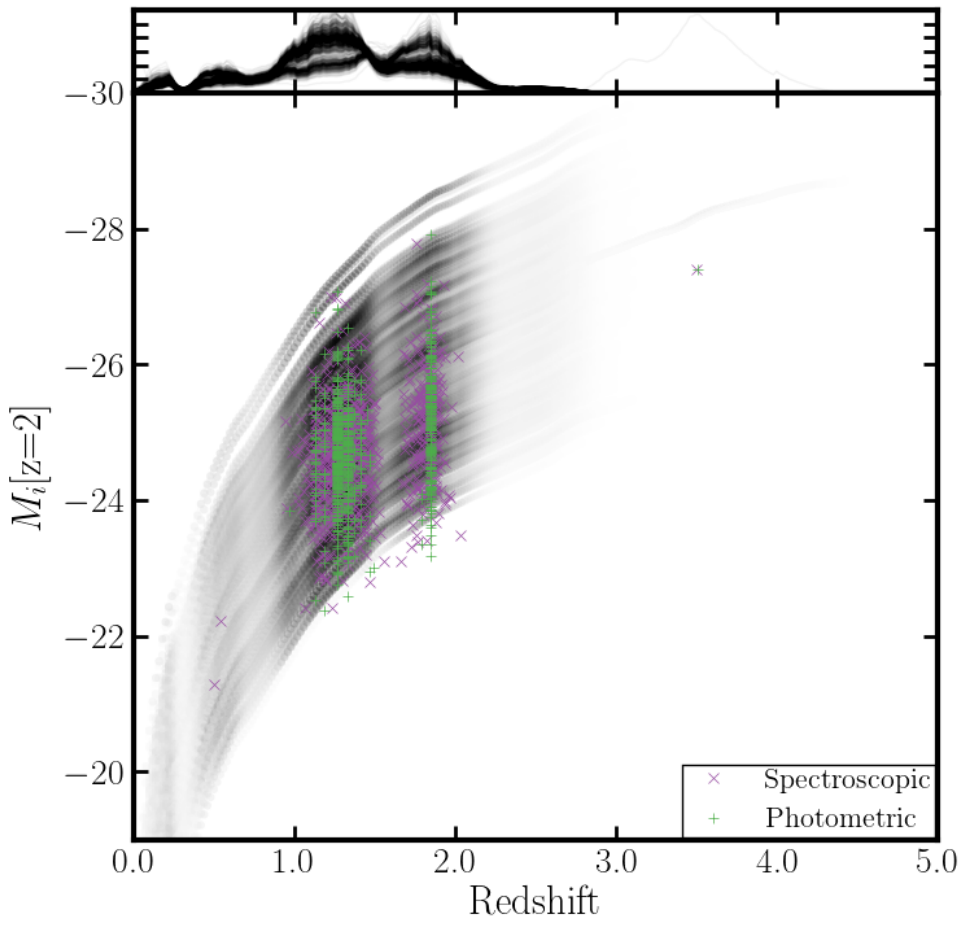

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- Using the full PDF gives you a lot more information.
- Implementing this is practice is difficult, but has been done for quasar luminosity functions. (Kelly et al. 2008)
- I have plans to do this for BEAMS.