

# The Low Importance of Spectral Features in Photometric Classification of Supernova Light-curves

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+Pippin!

SCAM @ UChicago & KICP

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# ML Classification is really good now...

## SNIRF

### PSNID

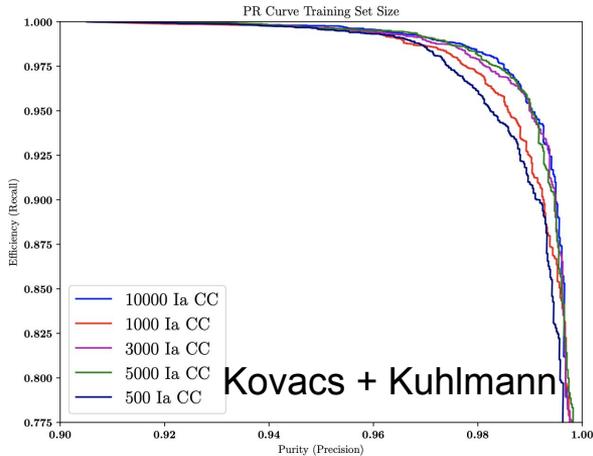
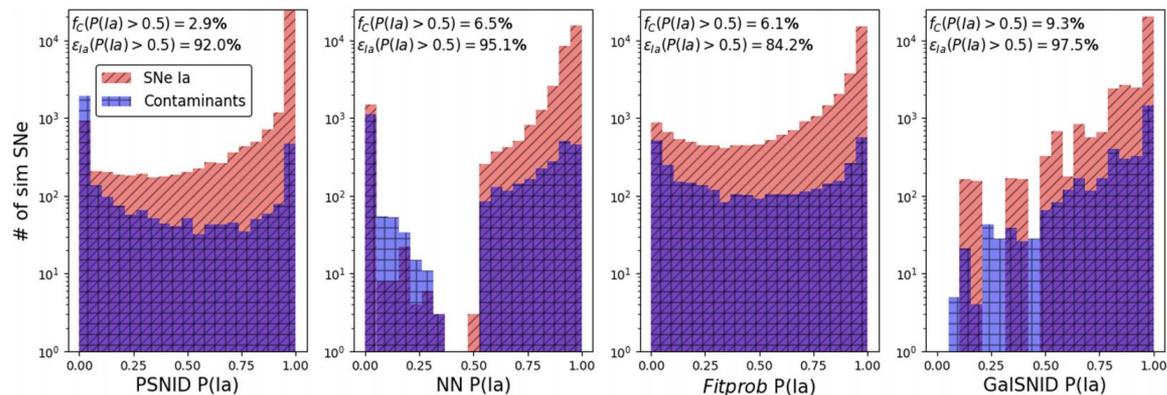
### NN

### Fitoprob

### GalSNID

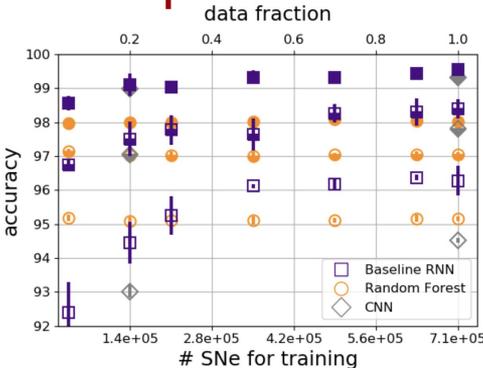
THE ASTROPHYSICAL JOURNAL, 843:6 (23pp), 2017 July 1

Jones et al.

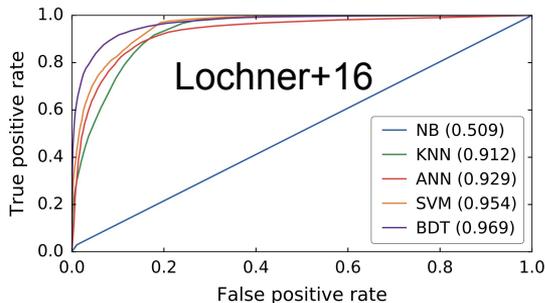


Kovacs + Kuhlmann

## SuperNNova



## SNMachine



Lochner+16

And more.....

Möller & Boissière 18

2 probs

Spectra are costly

Phot → spectra mangling → back to phot!

Templates currently come from targeted searches. LF of CC pops → fill in with photometric sne. Inherent problems use templates that are used are generated from High SNR events, but the contaminants happen at lower snr. Current sims dont perfectly match the data -> not all subtypes are encapsulated.

Vincenzi saw this too.

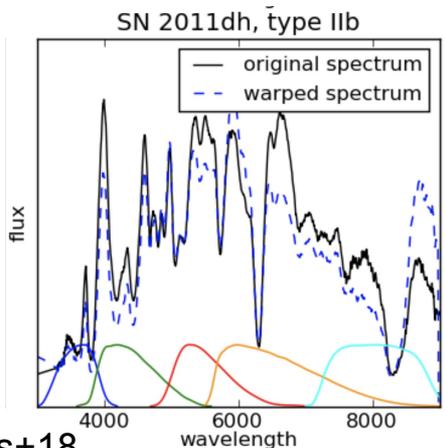
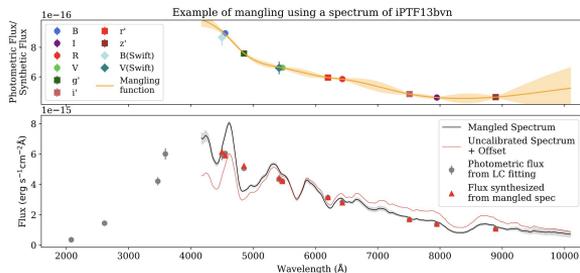
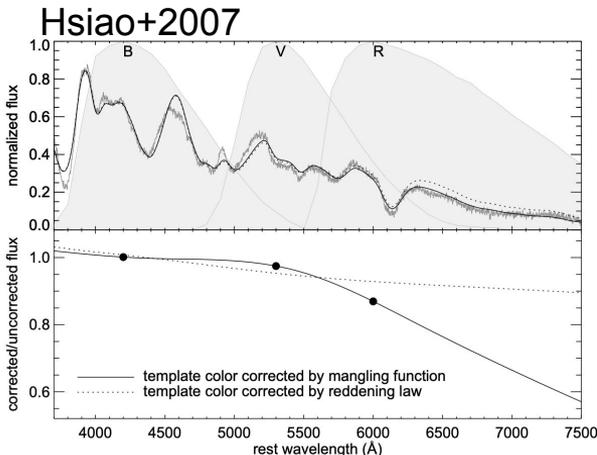
# Libraries need to encapsulate the full diversity of non-las

There are very strong efforts to build a diverse libraries:

1. Taking spectra
2. Mangling: Spectra are flux calibrated by mangling to match the broad-band photometry

But how much do these spectral features make it through to photometric datasets and how much do you gain from attempting to preserve them

And how much do you lose from the associated risks in adding unwanted features

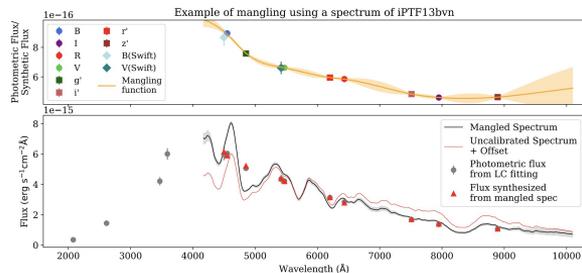
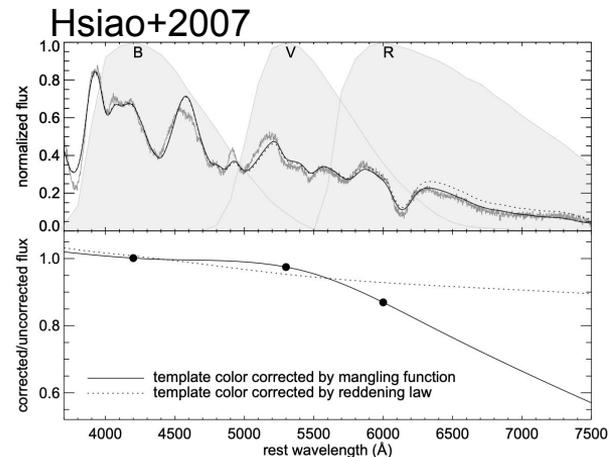


Vincenzi+19

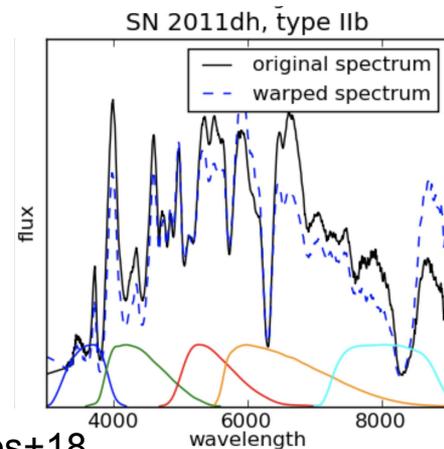
Jones+18

# Current methods involve spectral warping.

- Mangling: Spectra are flux calibrated by mangling to match the broad-band photometry
- The spline interpolation can also produce discontinuities in the mangling function for SNe for which photometry in neighbouring filters with close effective wavelengths



Vincenzi+19



Jones+18

# Here is what I do

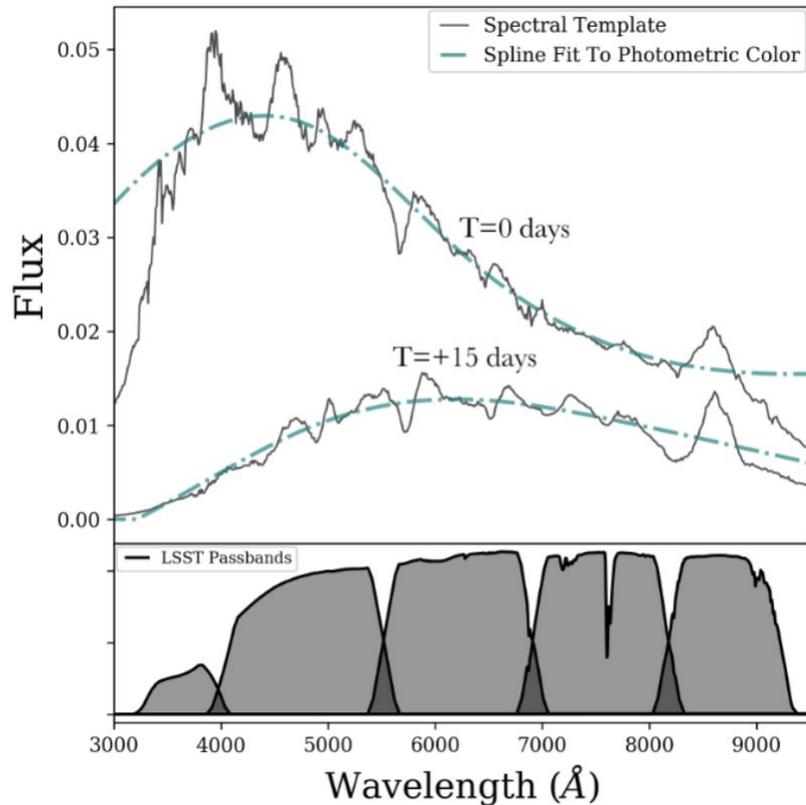
PLAsTiCC Non-Ia Templates w/ spec features

Redshift to some  $z < 0.5$

Apply SDSS/LSST passbands

Spline interpolation = fit SED w/o spec features

De-redshift  $\rightarrow$  set of featureless CC templates



# Here is what I do

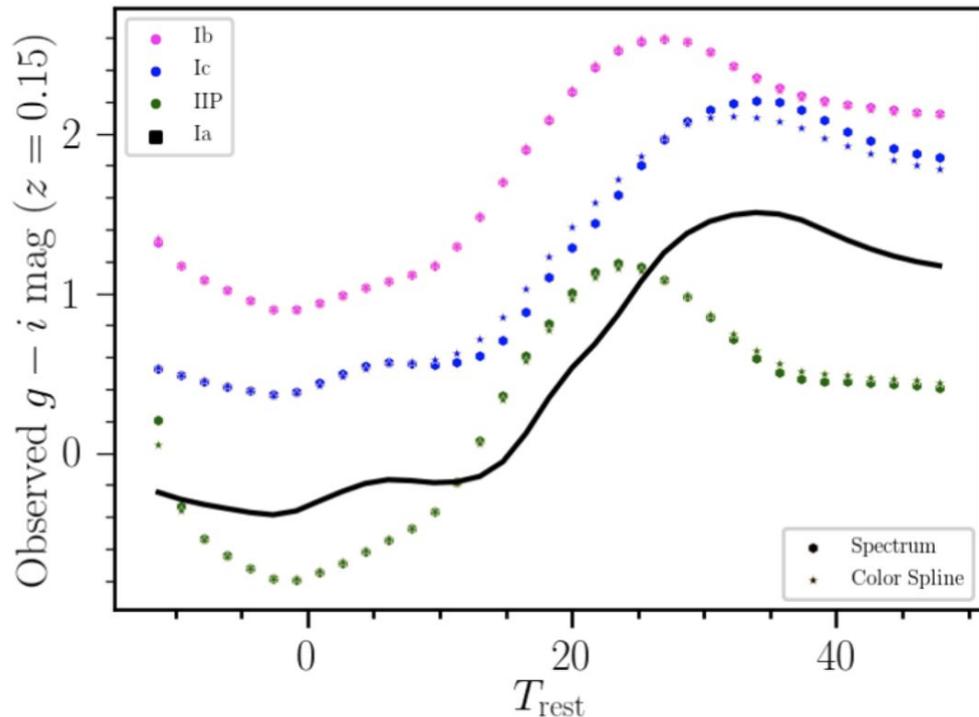
PLAsTiCC Non-Ia Templates w/ spec features

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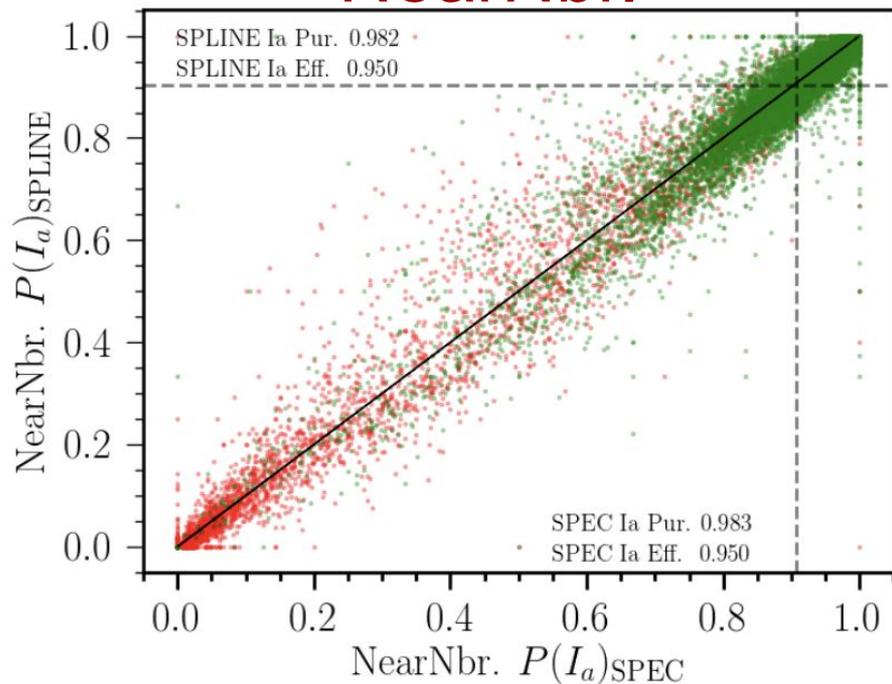
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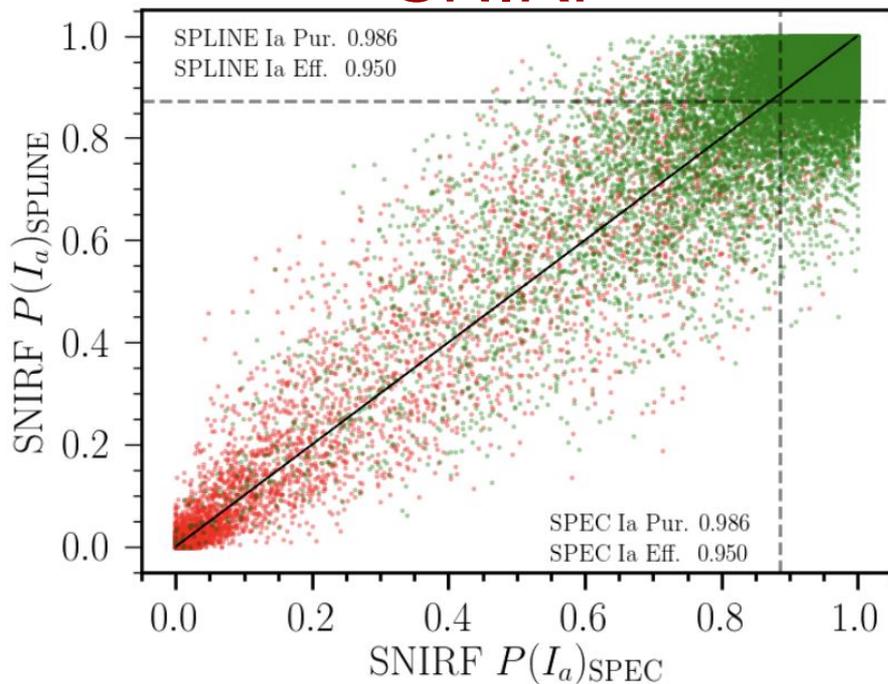


# Comparison of Probabilities w/ and w/o spectral features

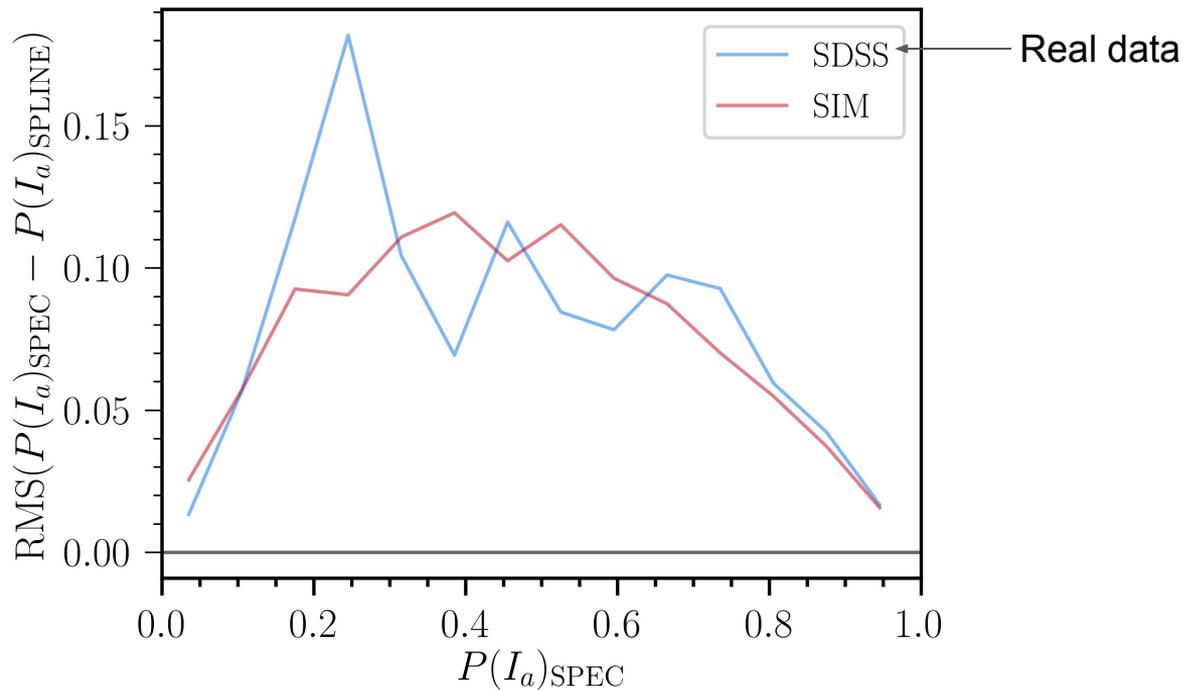
## NearNbr.



## SNIRF

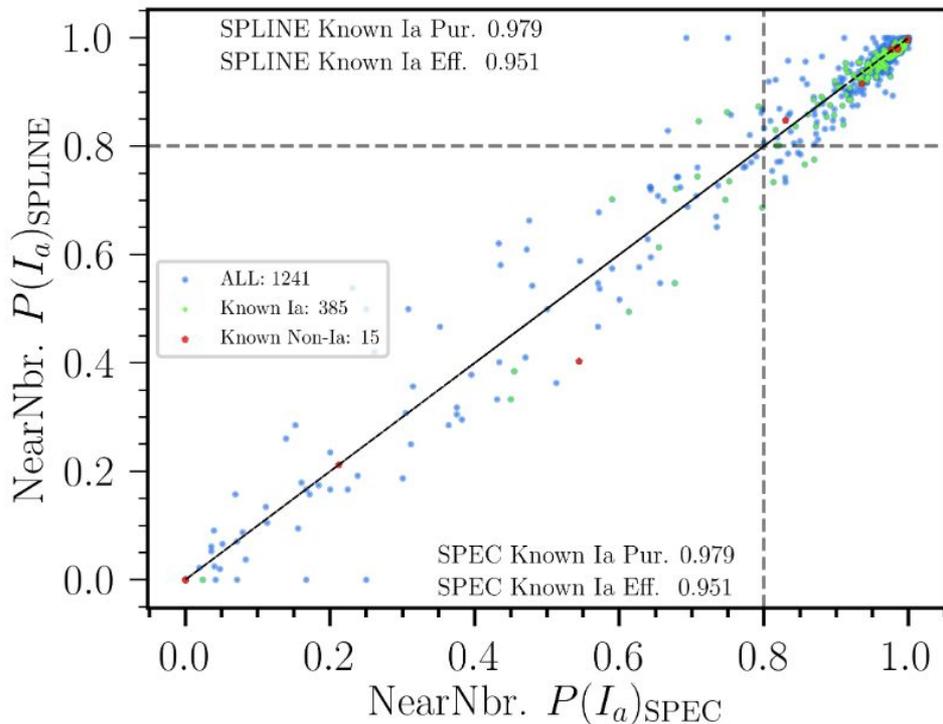


# Probabilities at the extremes agree well

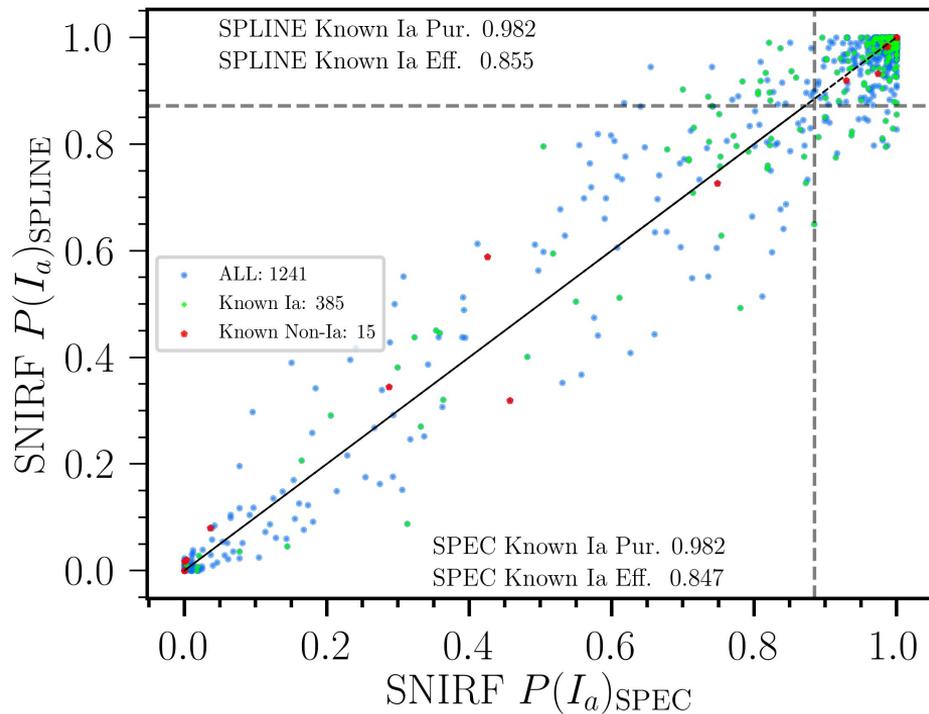


# Real SDSS Data (Sako+18)

## NearNbr.



## SNIRF

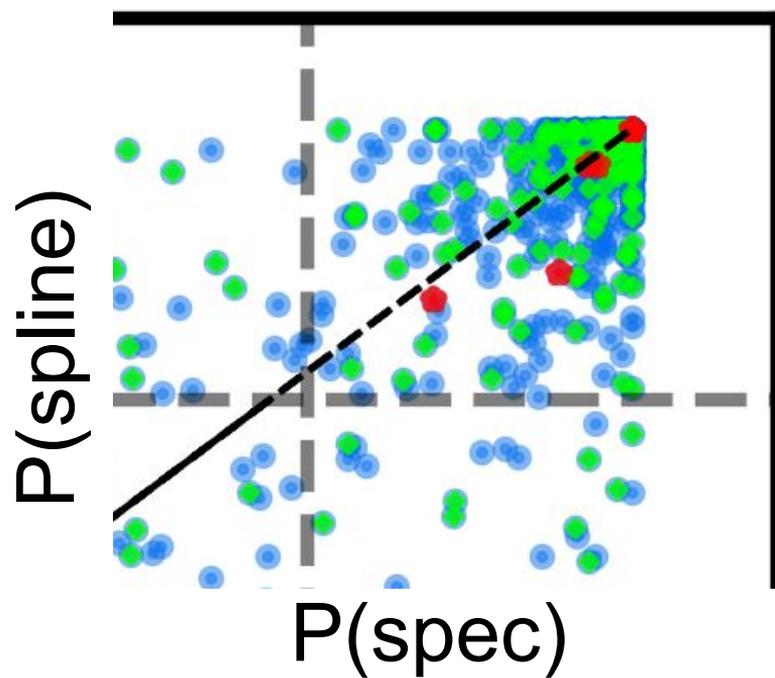
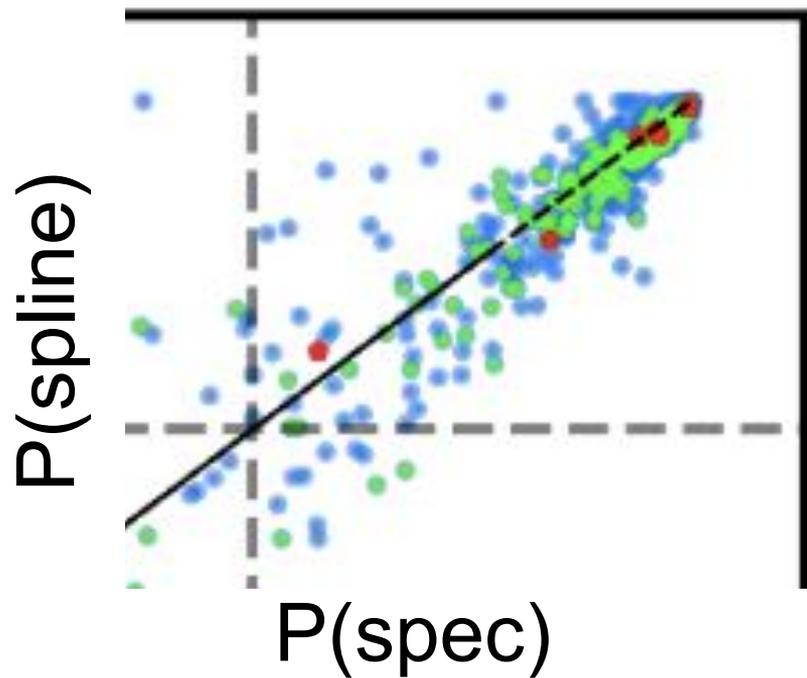


# Real SDSS Data (Sako+18)

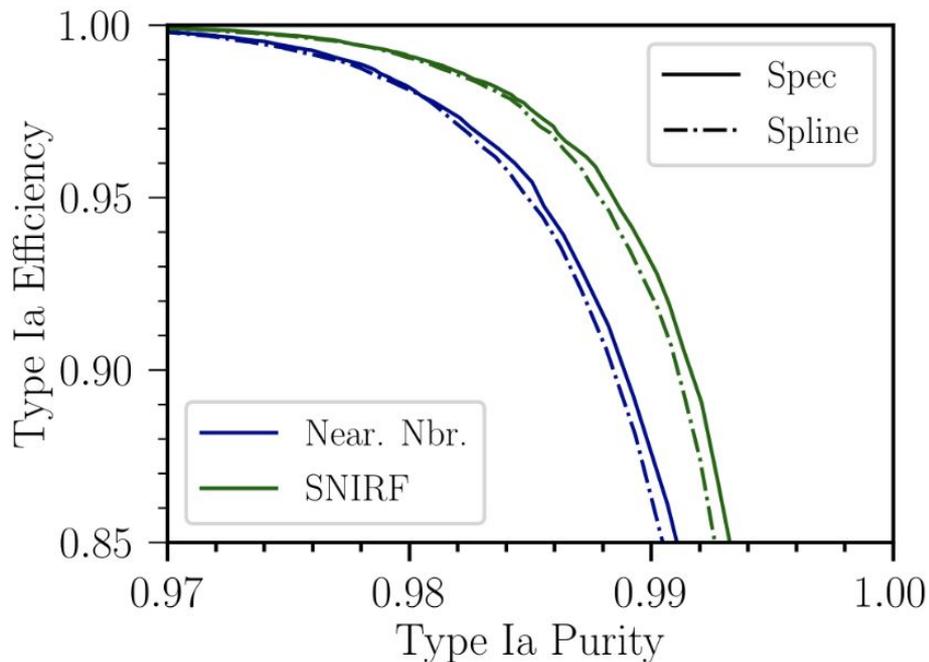
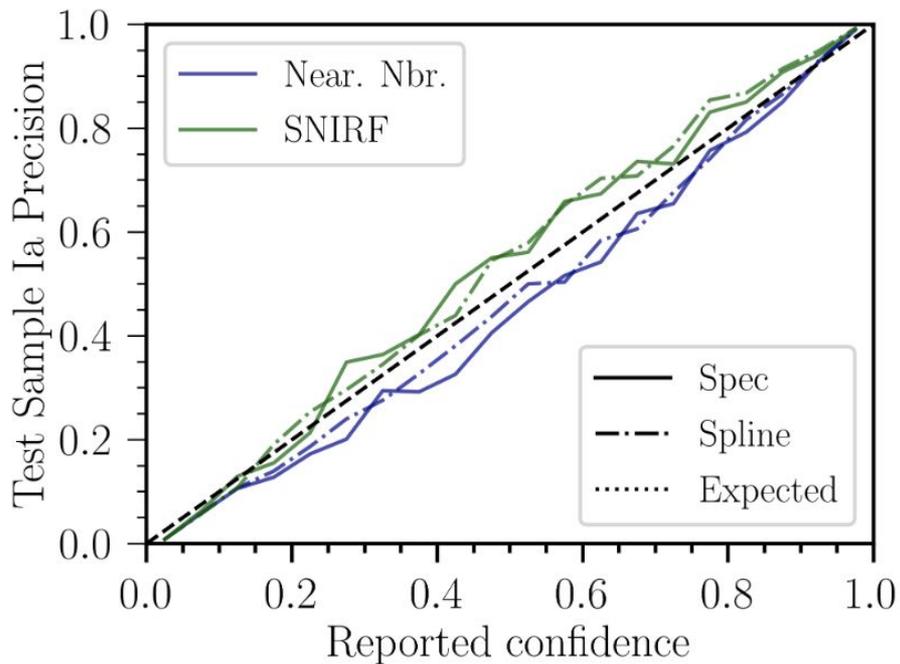
NearNbr.

- Known Ia
- Known Non-Ia

SNIRF

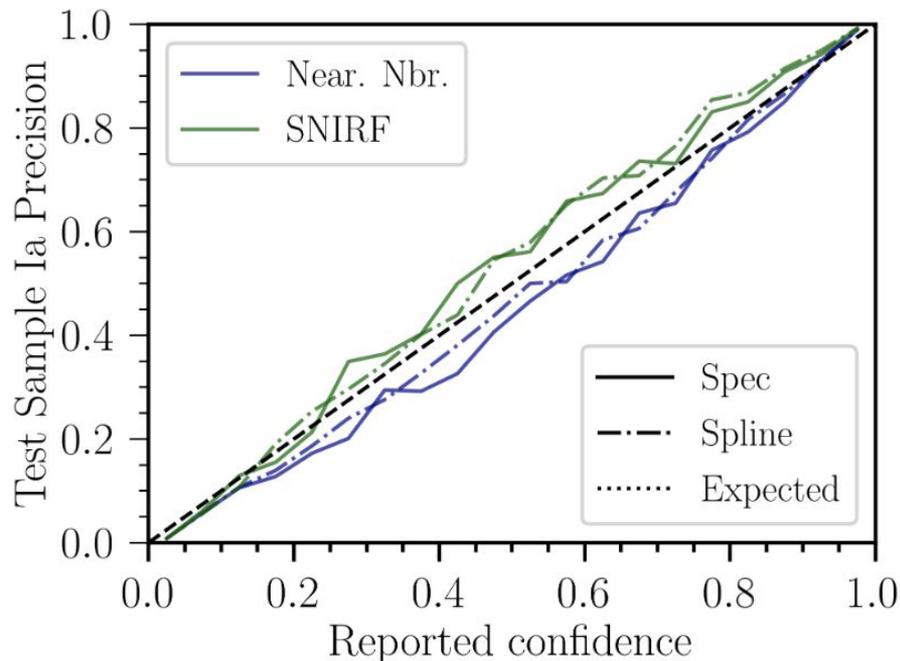
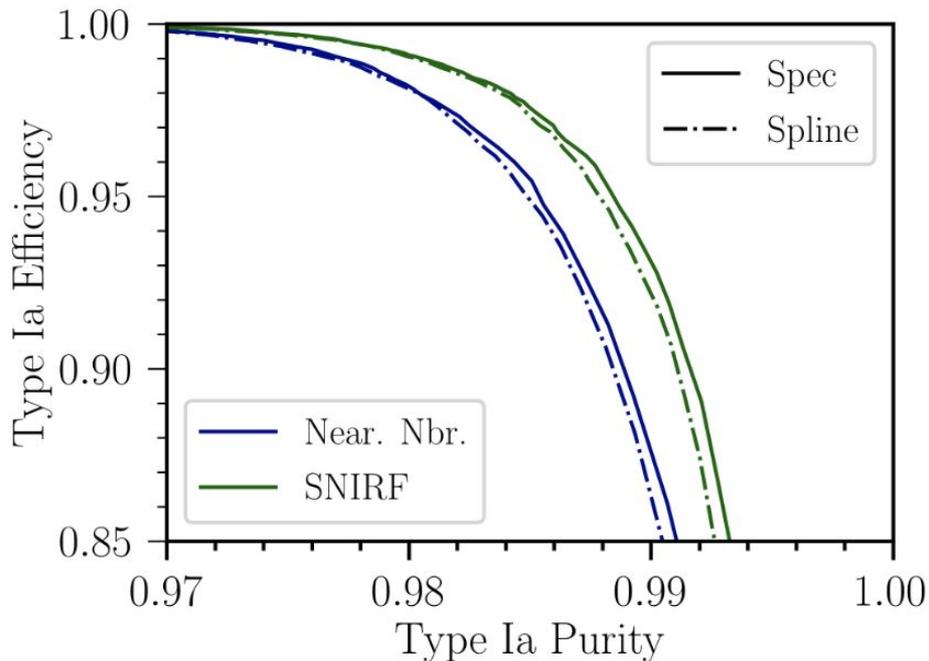


# Purity, Efficiency, and Probability Calibration



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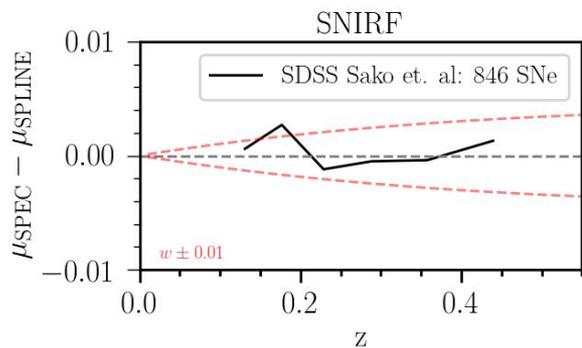
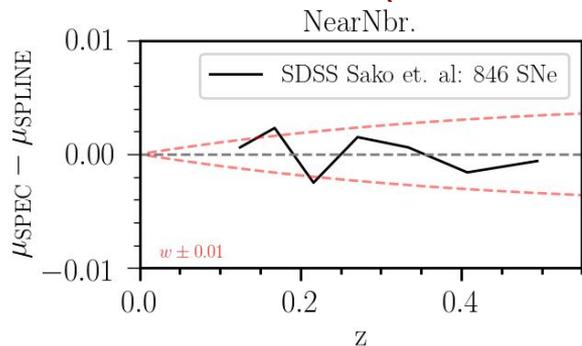
How much do the small differences matter for BEAMS  $\rightarrow$  Distances  $\rightarrow$   $w$  ?



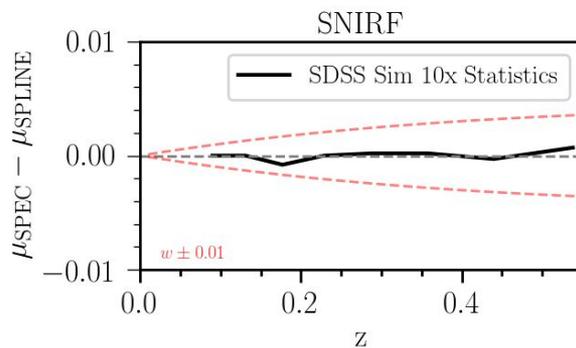
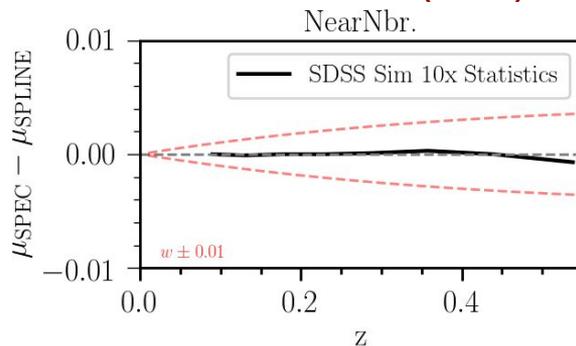
# Goes the Distance (and $w$ )

Dataset	# SNe	$w_{\text{SPEC}} - w_{\text{SPLINE}}$	
		NN	SNIRF
SDSS '18	902	-0.002	0.001
SDSS Sim 10x	10,000	0.000	0.001
LSST Sim	50,000	0.003	-0.001

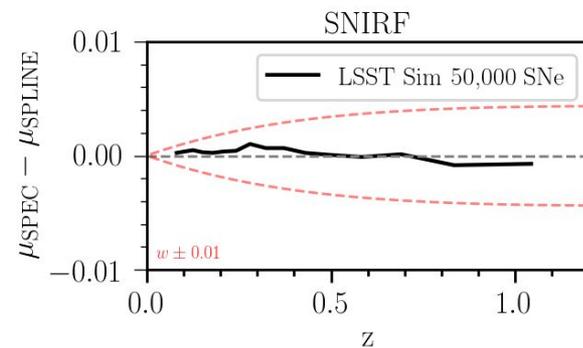
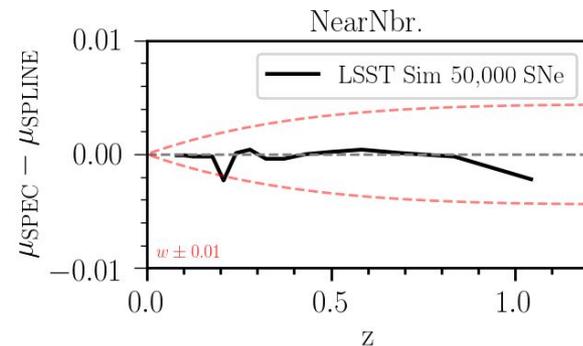
## SDSS Data (Sako+18)



## SDSS Sim (10x)



## LSST Sim



## In Conclusion → Panel Discussion

Do we need to rethink what is necessary for encapsulating the diversity in non-las?

Can a single spectrum for typing and a redshift be enough to build much larger training libraries?

Is this sufficient for LSST/WFIRST cosmology?