PhD thesis with PTF and iPTF type Ia supernovae

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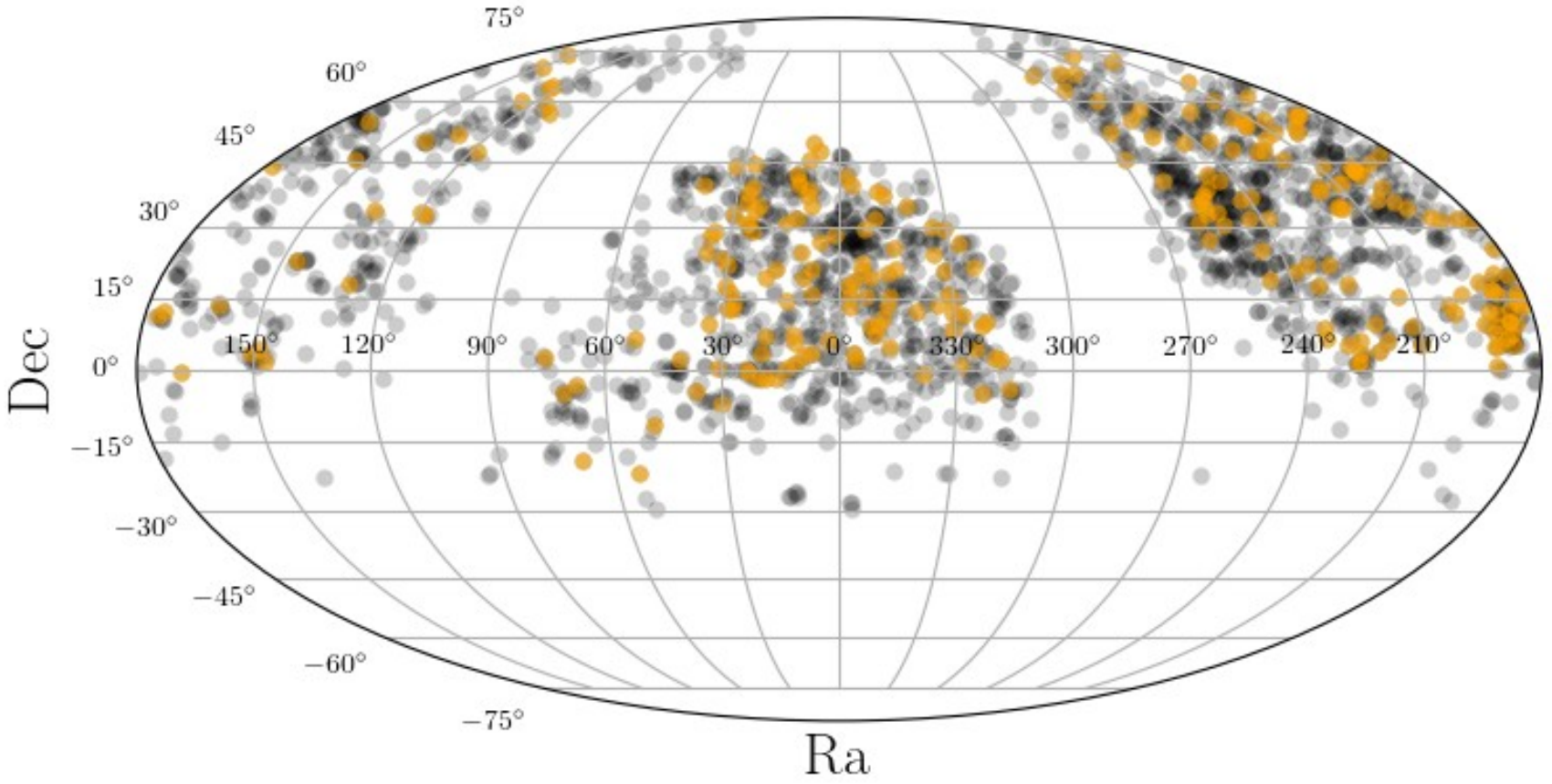
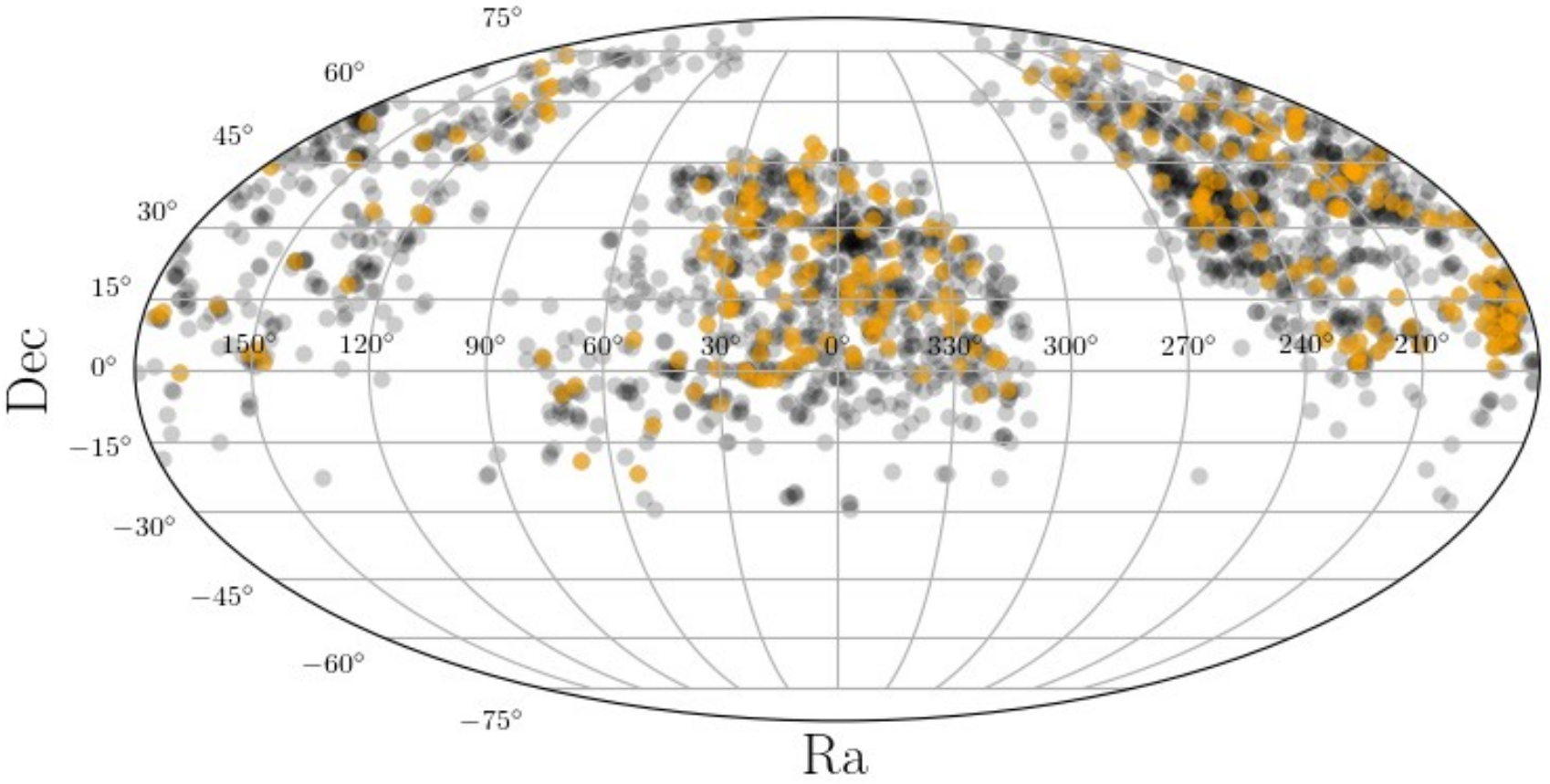
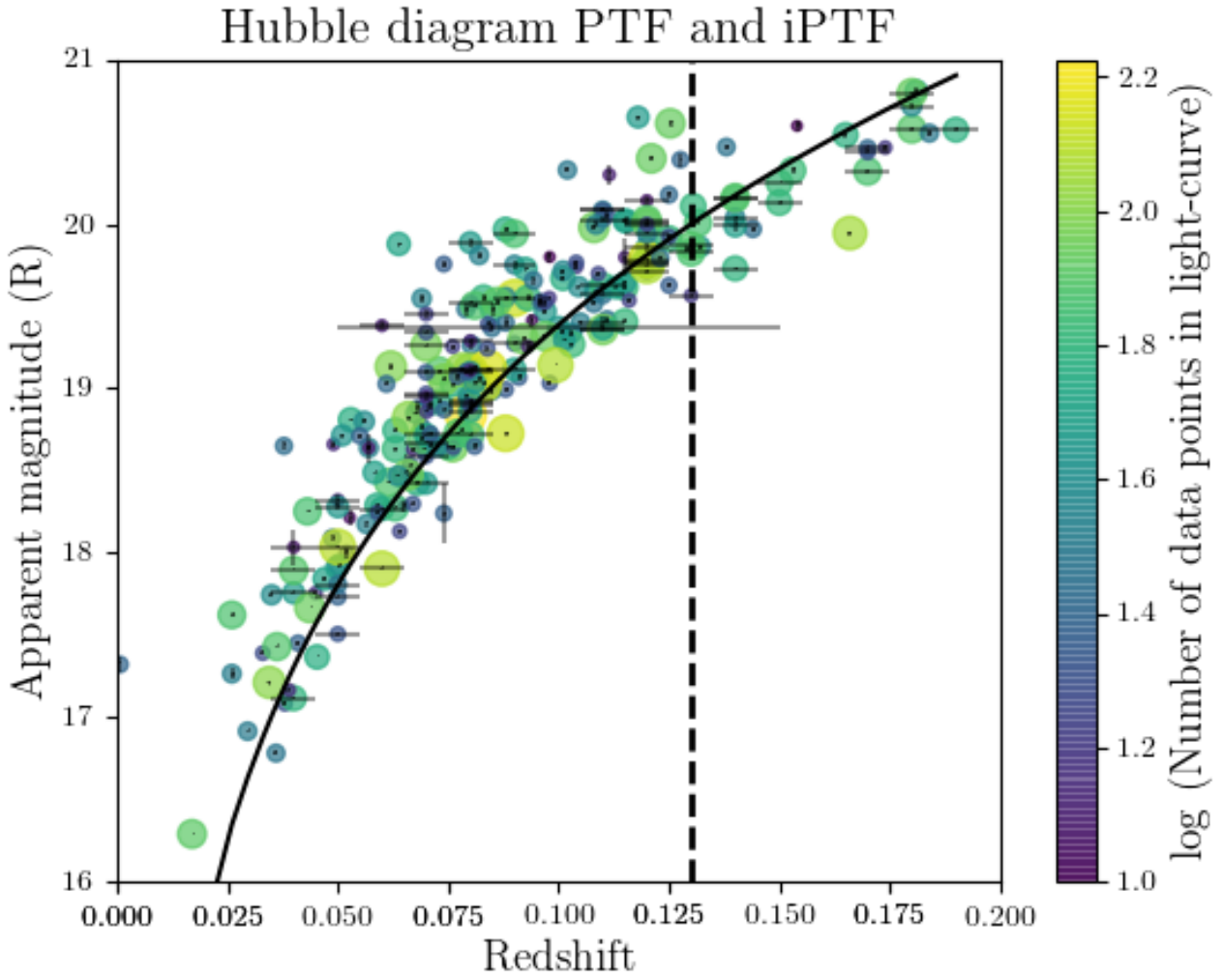
2060 Type Ia SNe from PTF and iPTF - What can we do with them?



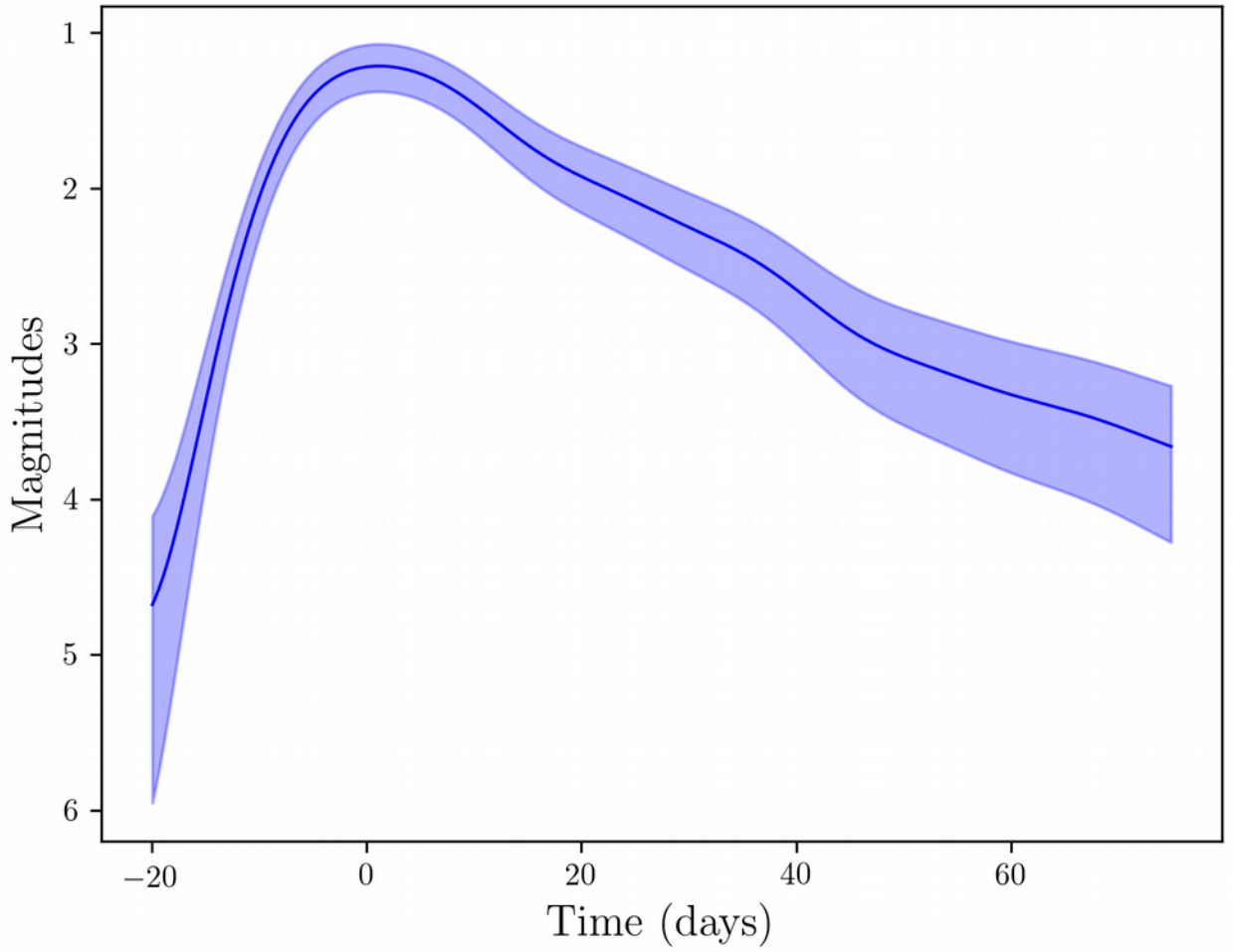
Sampling bias is minimized in a rolling search such as PTF and iPTF



Characterising the statistical and systematic uncertainties makes type Ia SN better distance indicators.



Using Gaussian processes we can explore the intrinsic scatter and multiple populations in the data.



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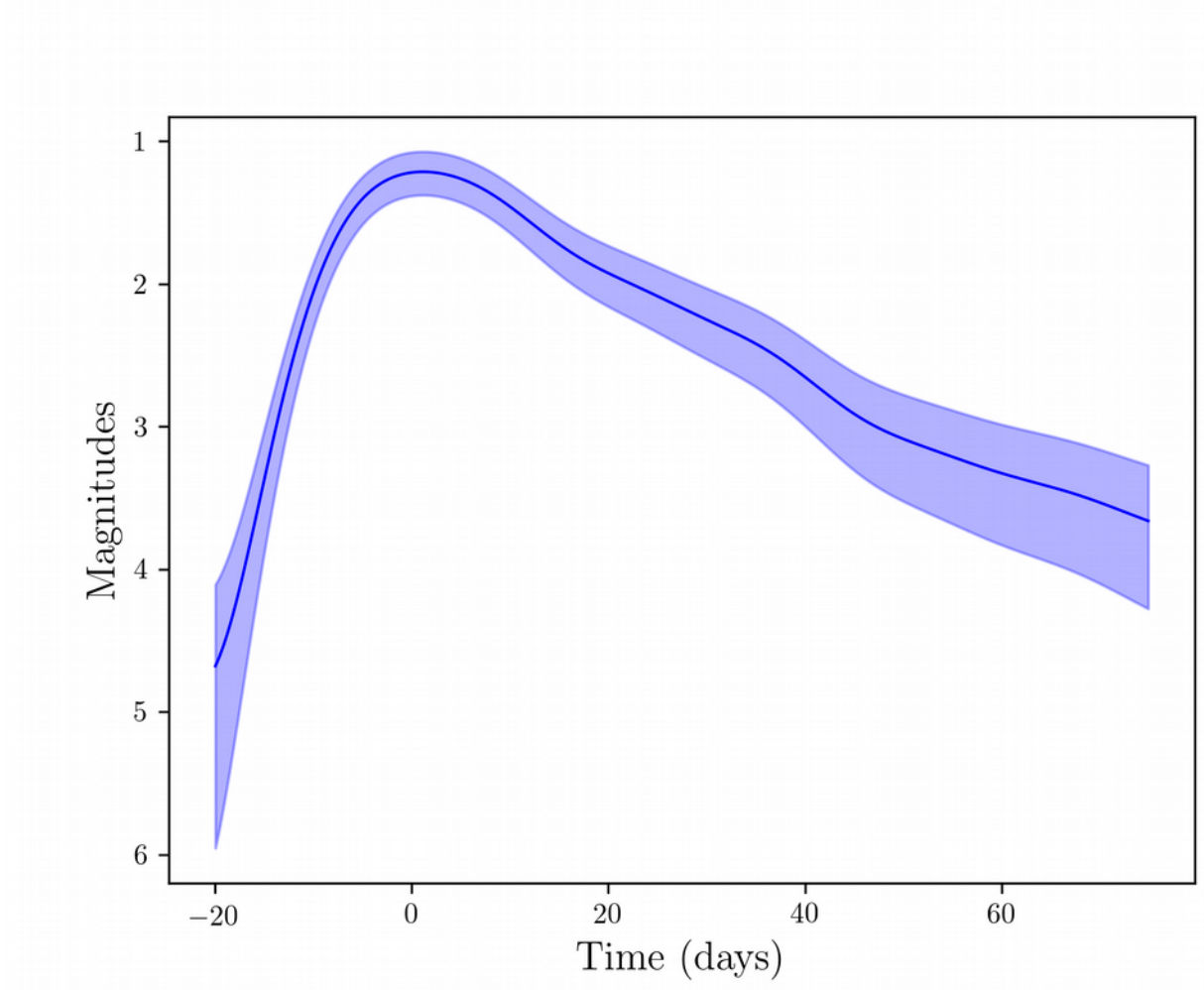
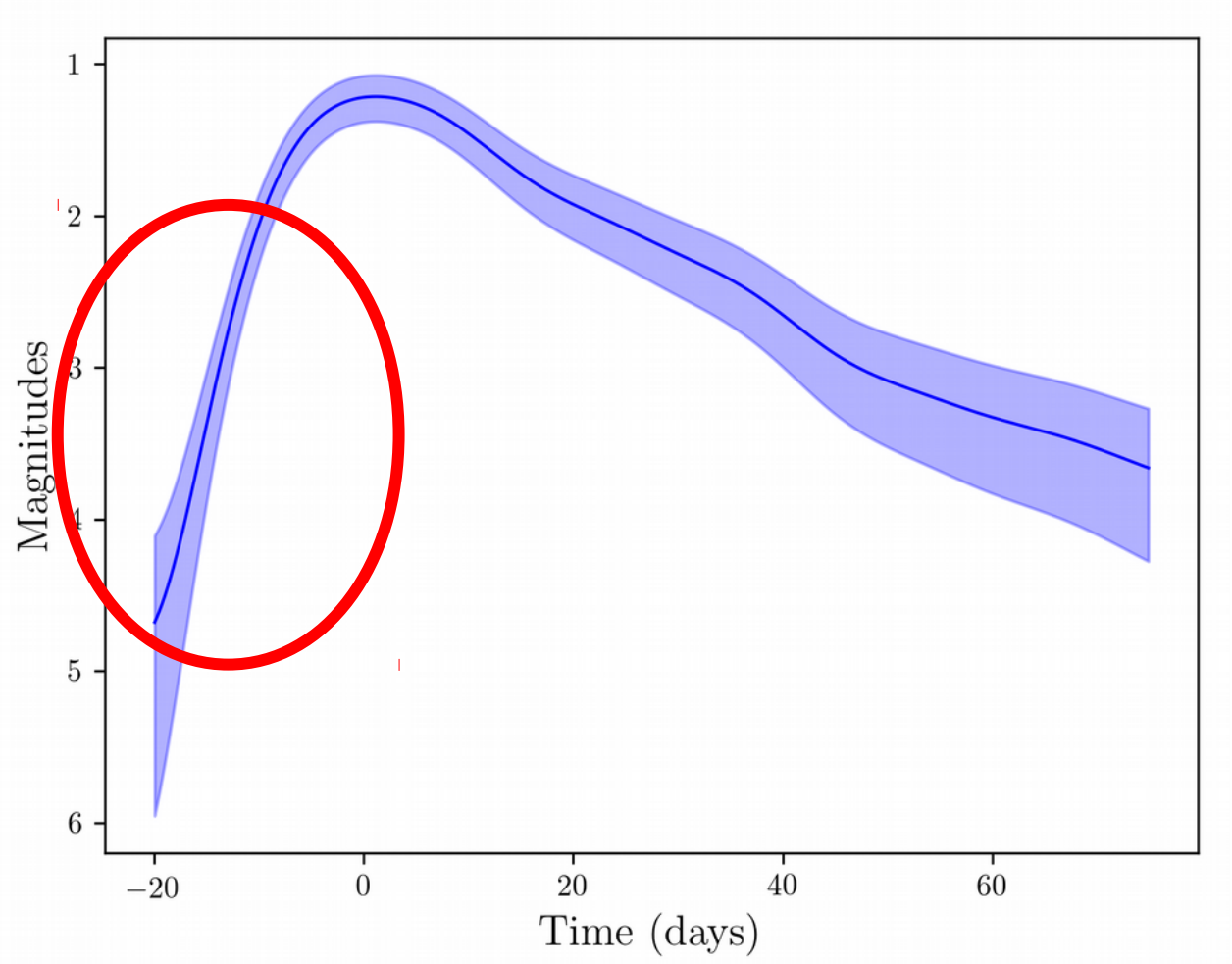


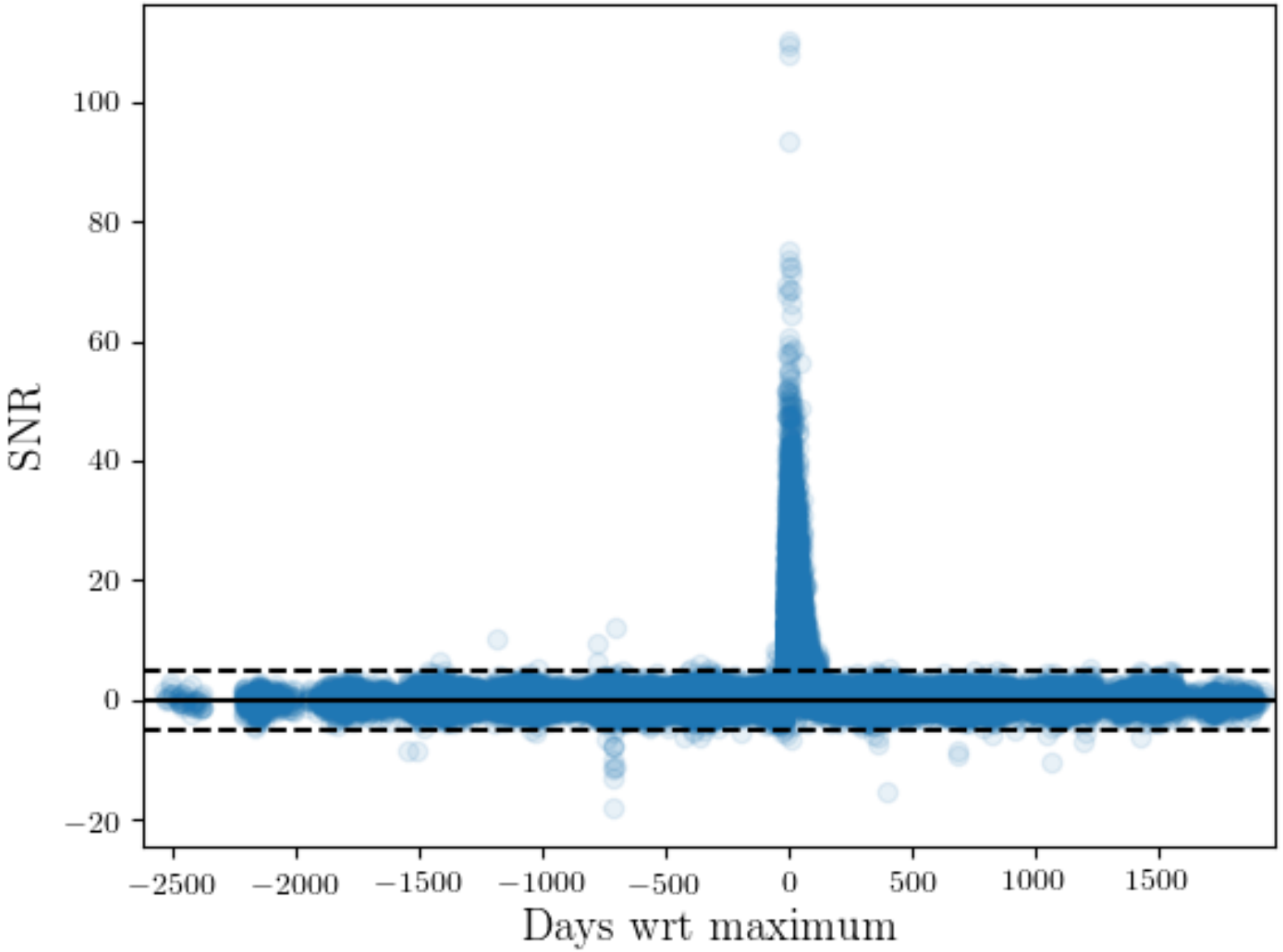
Requires 2 TB of RAM and a couple of days on a supercomputer.

Using Gaussian processes we can explore the intrinsic scatter and multiple populations in the data.

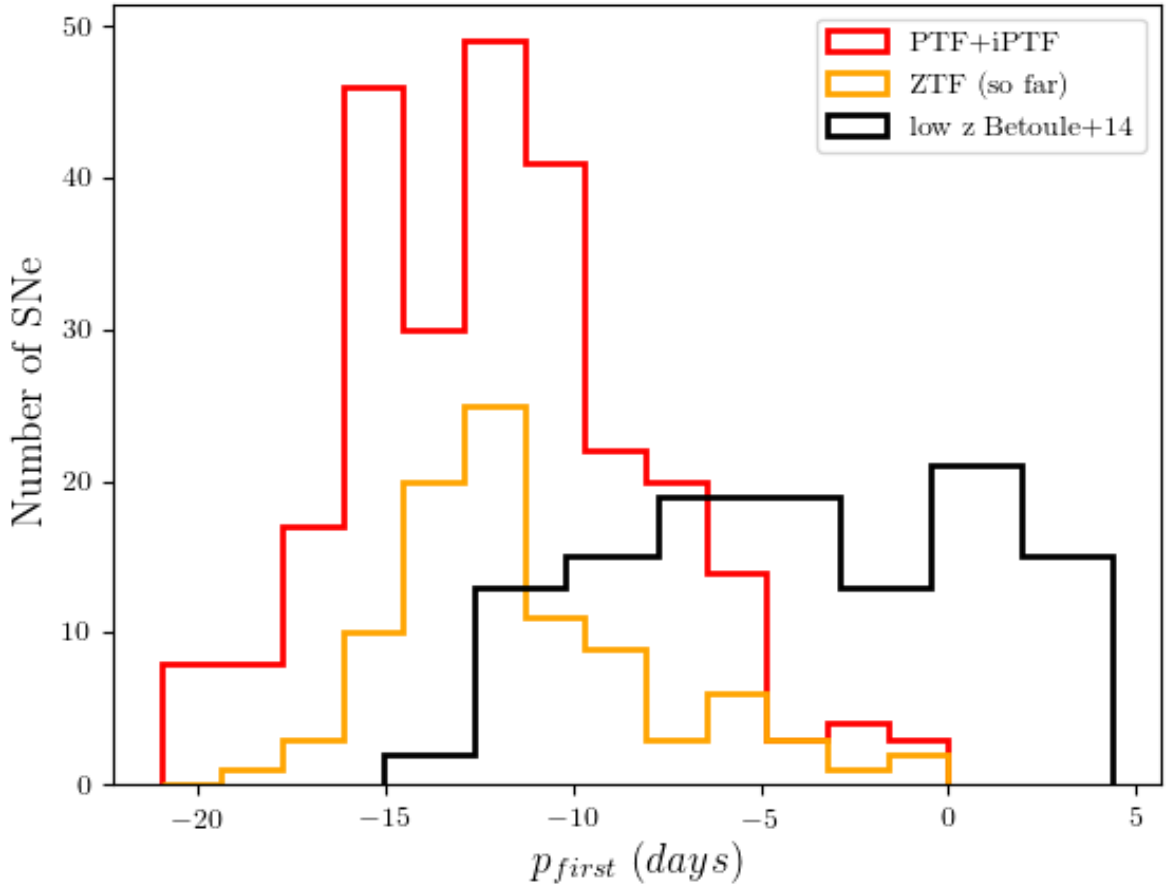
No evidence for multiple populations at early times



Taking advantage of long history to search for pre-and post explosion bursts



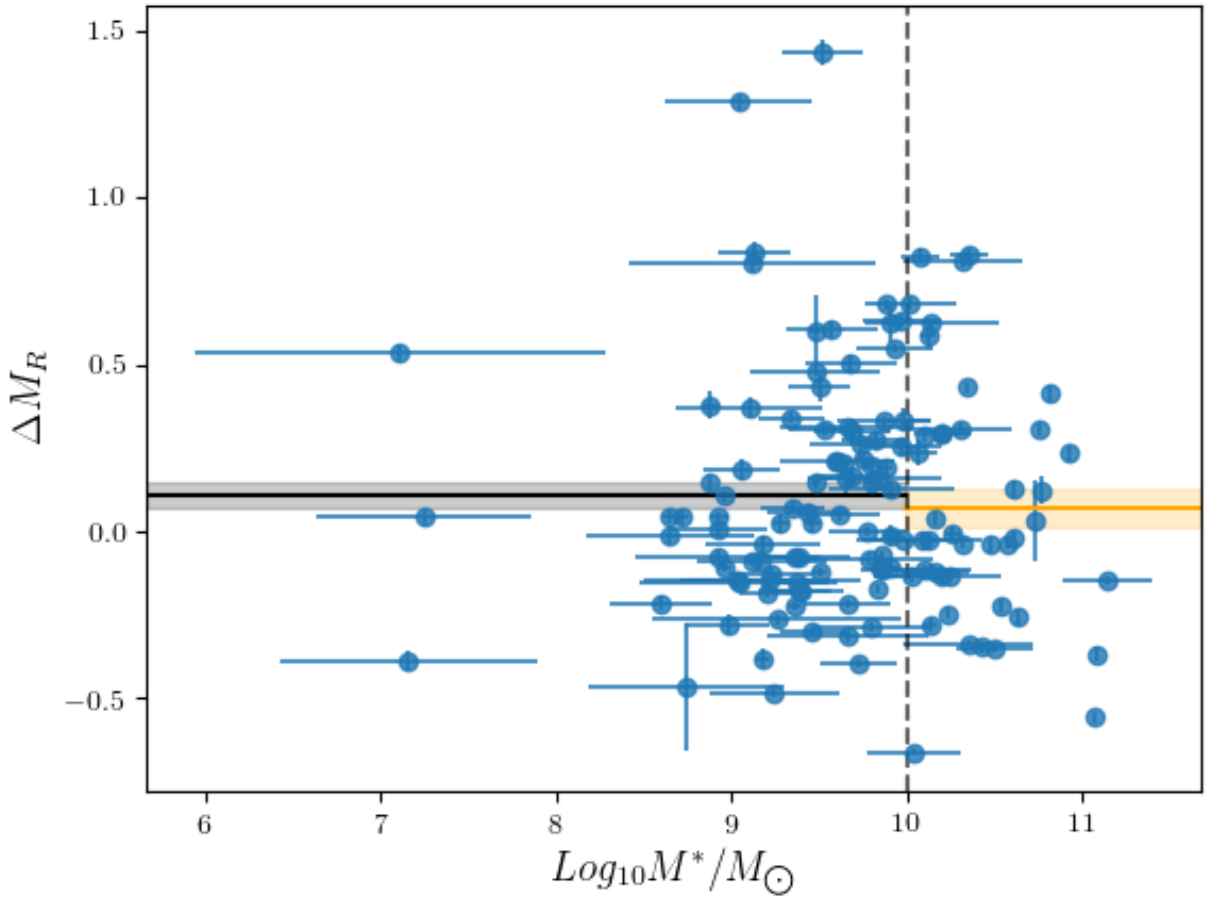
Investigating the early Ia light-curve



Can get average properties such as rise time of our sample using method from Zheng+17:

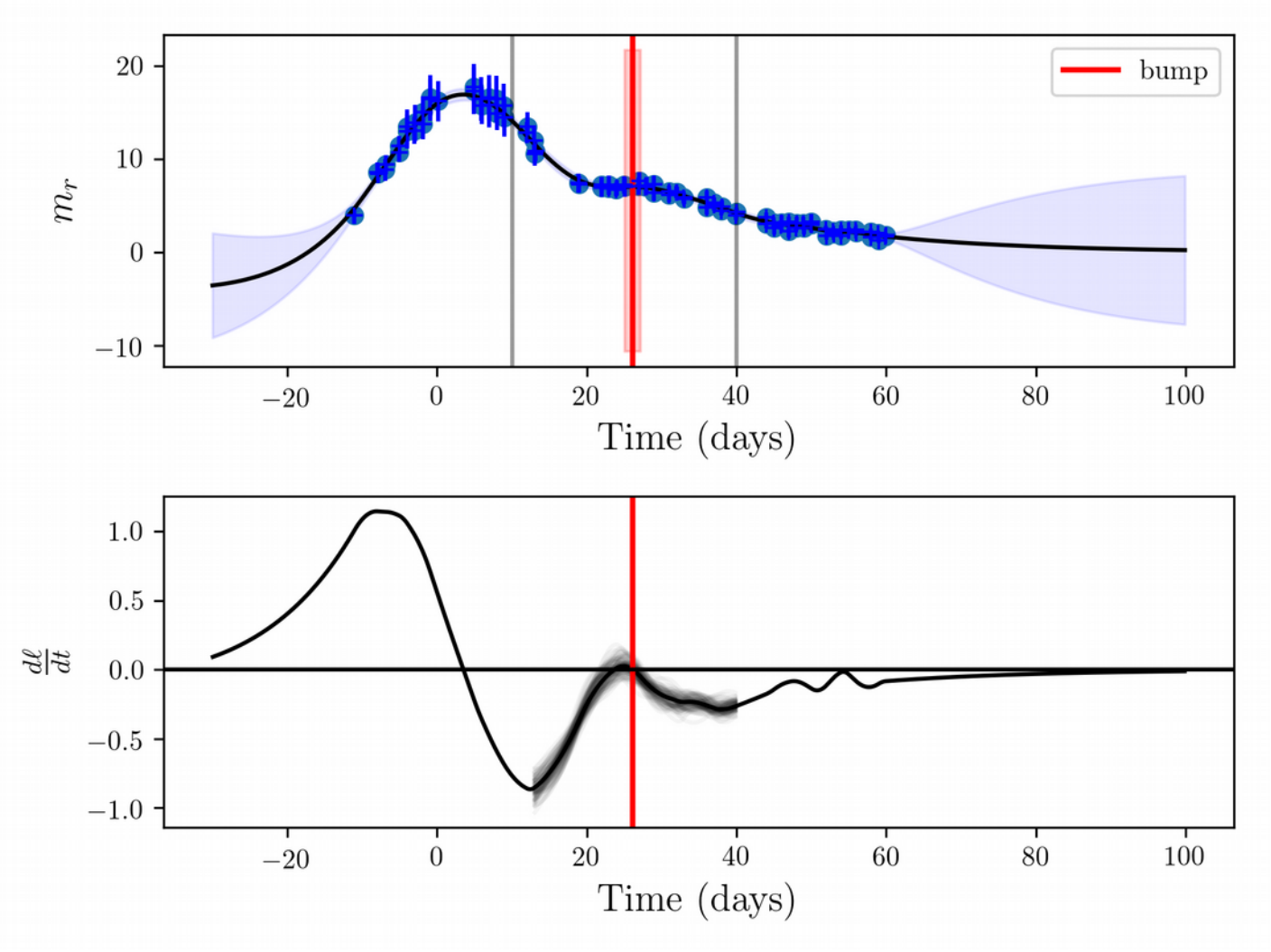
$16.8^{+0.6}_{-0.5}$ *days*

No correlation found between Hubble residual and host mass

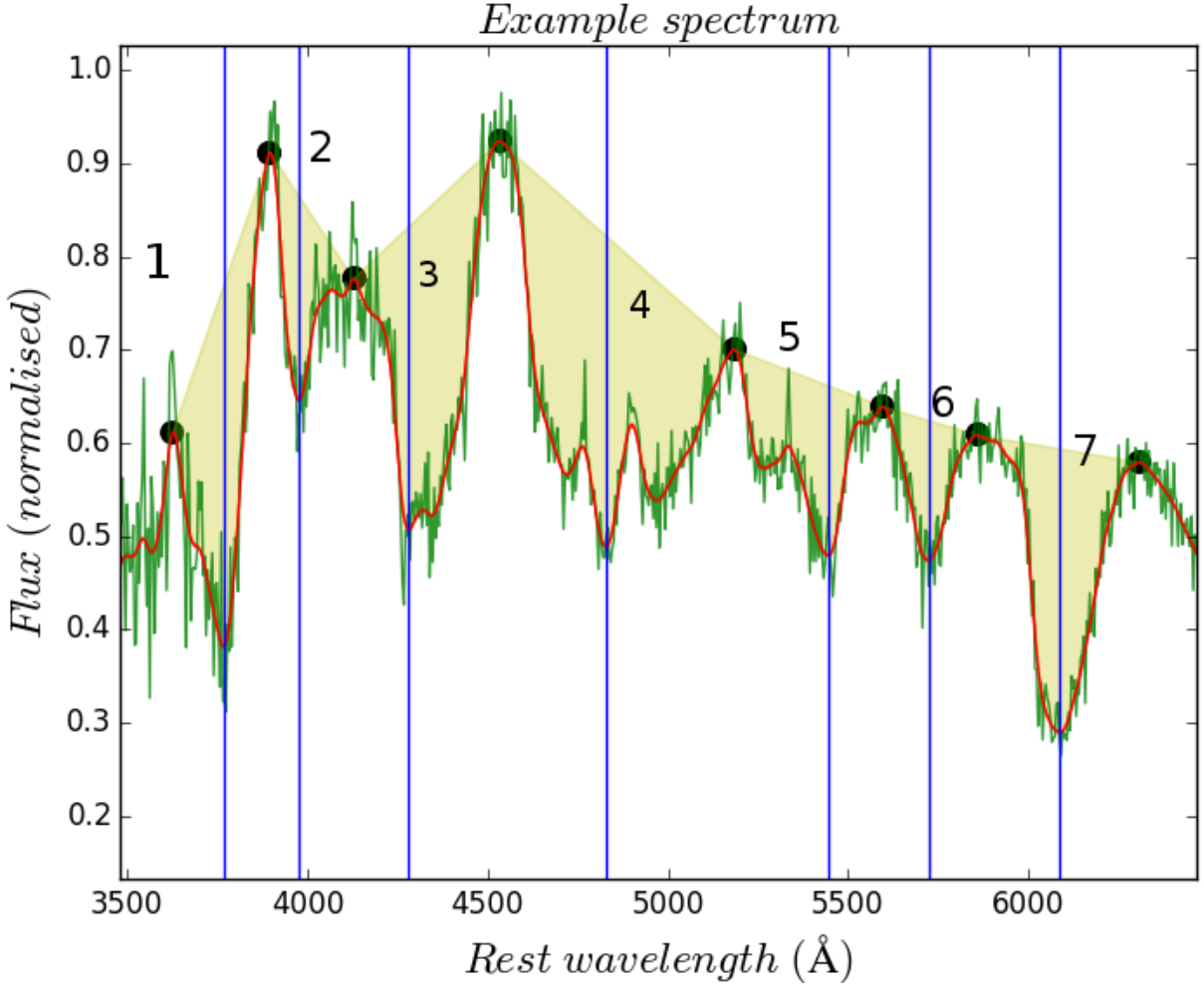


Not corrected for colour!

Correlations between the secondary bump in R-band and SNe physics



We analysed the ~2300 spectra automatically to look for correlations between spectral parameters and Hubble residuals.



Some of the uncertainties we looked for:

- Malmquist bias
- Average extinction
- Intrinsic scatter with epoch
- Multiple populations
- Early light-curve properties
- Pre- and post explosion bursts
- Spectral properties that could help

Conclusion

Sampling bias	None in PTF + iPTF sample
Pre-post explosion flares	None found
Early light-curve	Average properties calculated
Intrinsic scatter	GP template
Host galaxy mass correlation	No evidence in our sample
Secondary bump	Correlation with Ni mass of ejecta
Correlations with spectral properties	No strong correlations found

Everything learned here is applied to ZTF type Ia cosmology where we will measure colours (and get individual SN extinction) and a large sample of beautiful Ia light-curves (and spectra?) to measure properties for.

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