

## **RCF Projects** 07-15-2020





- RCF Lightcurves (forced photometry) and analysis, Miller +
- RCF web portal + basic rates and statistics on the sample, Perley+
- Classification and subtype analysis of 2019 sample, Fremling, Miller + students + whole team
- SNIascore, Deep learning SEDM classification, Fremling+
- SN Ia lightcurves, rate and luminosity function, Biswas, Goobar + OKC +
- SNe as tracers of the Large Scale Structure (Tsaprazi + OKC)
- Host galaxy analysis, Perley + Shulze +
- Neutrino Correlation with RCF SNe, Necker + DESY +
- SNe II, correlation of photometric and spectroscopic properties (Goldwasser + Weizmann +)
- Deep learning subtype classification (Sharma)

# RCF lightcurves, forced photometry, and analysis, Miller + working on producing final LCs for all RCF SNe since 2018

analysis will be based on parametric model fitting



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Classification and subtype analysis of 2019 sample Fremling, Miller + students + whole team

SNID, Superfit (python version), DASH, etc. to finalize classifications and redshifts analysis will contain statistics on SN subtypes in RCF



#### RCF statistical sample and web portal Perley, Fremling +



https://www.astro.caltech.edu/ztf/bts/bts.php

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#### SNIascore, Deep learning SEDM classification, Fremling+

Comparison to DASH (Muthukrishna et al., 2019), CNN network

0.6 • False Positive rate • False Negative Rate 0.5 0.4 FPR/FNR 0.3 0.2 0.1 0 0.3 0.4 0.5 0.1 0.2 0.6 0.7 0.9 0.8 0 SNIa-score

**BiLSTM+GRU** 

Out of 761 RCF SNe from 2018

	SNIascore_2	SNIascore	DASH	TRUTH
SNe la	474	466	302	533
%	88.9%	87.4%	56.6%	
FPR	0.6%	2.7%	9.6%	

#### (SNID, ~100 correct)

### Rates/Luminosities of SNIa using ZTF BTS Biswas, Goobar + OKC +

• Describe population distribution of SNIa : rate parameter  $r_v$  and a distribution of properties (e.g. Normal with unknown parameters eg. mean)



- Ongoing work at OKC + ZTF collaborators : simultaneously infer both  $r_v$  and parameters like  $\overline{c}$  from measured values of c in the (red) ZTF sample. Extends to other transients, multi-parameter complex distributions
- People involved at OKC : Biswas, Goobar, Mortlock and Peiris

#### - SNe as tracers of the Large Scale Structure (Tsaprazi + OKC)

### **ZTF x BORG:** SN clustering at super-Mpc scales



- E. Tsaprazi, A. Goobar, J. Jasche, H.V. Peiris
- Do SNIa reside in higher-density large-scale environments than CCSN?
- Do SNIa reside in different cosmic-web structures than CCSN?



• Can SNe be used as tracers of the LSS where galaxy surveys are sparse?



## **BORG:** LSS simulations constrained by galaxy surveys **ZTF:** 342 Ia – 382 CC at z < 0.036 <u>iPTF testing sample:</u> 141 Ia – 274 CC at z < 0.036



#### RCF Host galaxy analysis, Perley + Shulze +

ZTF18aauizer	ZTF18aaumeys	ZTF18aasxvsg	ZTF18aaunfqq	ZTF18aawjywv	ZTF18aaxentm	ZTF18aaxdrjn	ZTF18aavrwhu
0	-	-		÷.,	0		
ZTF18aazixbw	ZTF18aazsabq	ZTF18abauprj	ZTF18abaxlpi	ZTF18aaytovs	ZTF18abbpeqo	ZTF18aaxcfbt	ZTF18abbvsiv
	1	•	6		1		-
ZTF18abcsgvj	ZTF18abceakp	ZTF18abcpmwh	ZTF18abdbuty	ZTF18abdbysy	ZTF18abcyhju	ZTF18abdfwur	ZTF18abdffeo
•		2.	•		(***		0
ZTF18abeecwe	ZTF18abdrbqp	ZTF18abetchf	ZTF18abffyqp	ZTF18abfgygp	ZTF18abfhryc	ZTF18abdkimx	ZTF18abetejo
			6		100	1	
ZTF18abixkjh	ZTF18abjgyyr	ZTF18abjtgdo	ZTF18abjvhec	ZTF18abjrfqx	ZTF18abkhcrj	ZTF18abkhcwl	ZTF18abkifng
-				-	1		
ZTF18abltaxf	ZTF18abltfho	ZTF18ablwtkf	ZTF18abmkaps	ZTF18abmmdif	ZTF18abmmkaz	ZTF18abmxahs	ZTF18abmxfrc
		•					1
ZTF18abpaywm	ZTF18abpmmpo	ZTF18abrlljc	ZTF18abrqedj	ZTF18abmwnov	ZTF18abqyvzy	ZTF18abrzcym	ZTF18absdgon
-	×				1	+	
TTC10-humite	ZTF18abwlopg	ZTF18abymobs	ZTF18abxxviv	ZTF18abxzcky	ZTF18abvkoma	ZTF18abzrgim	ZTF18acbueme

#### RCF Host galaxy analysis, Perley + Shulze +



#### Neutrino Correlation with RCF SNe Necker + DESY +

#### **High Energy Neutrinos from Stripped Envelope CCSN**



stripped envelope Type Ibc (no H/He emission lines)

> choked jet scenario Supernovae Ibc

courtesy of Kowalski, Bartos

- Neutrinos at around explosion time
- Knowing explosion time  $\rightarrow$  excluding more background
- Goal: constrain explosion time as good as possible



Idea:

- ▶ use SNe lbc from BTS sample
- estimate explosion time from lightcurves
- use explosion time estimate in IceCube Analysis





**DESY.** | Supernova Stacking Analysis | Jannis Necker

#### RCF SNe II, correlation of photometric and spectroscopic properties Goldwasser + Weizmann +

following the works of Anderson (LCs), Gutierrez (spectra) and Rubin (rise time)



