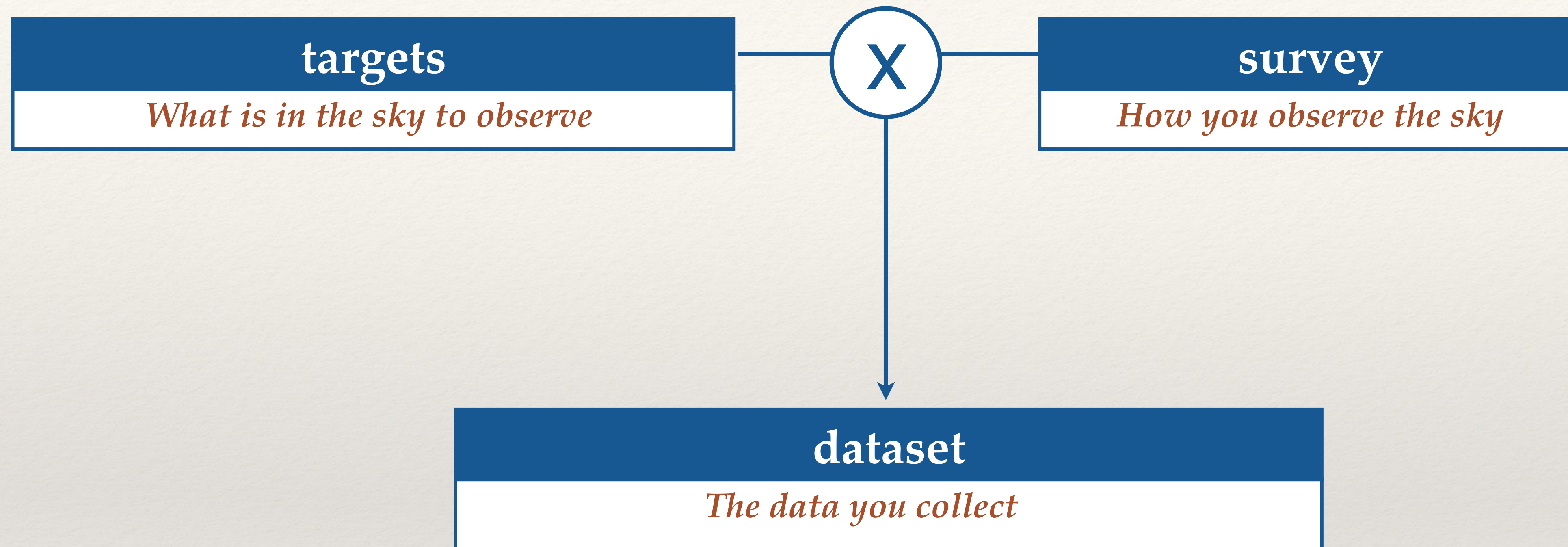




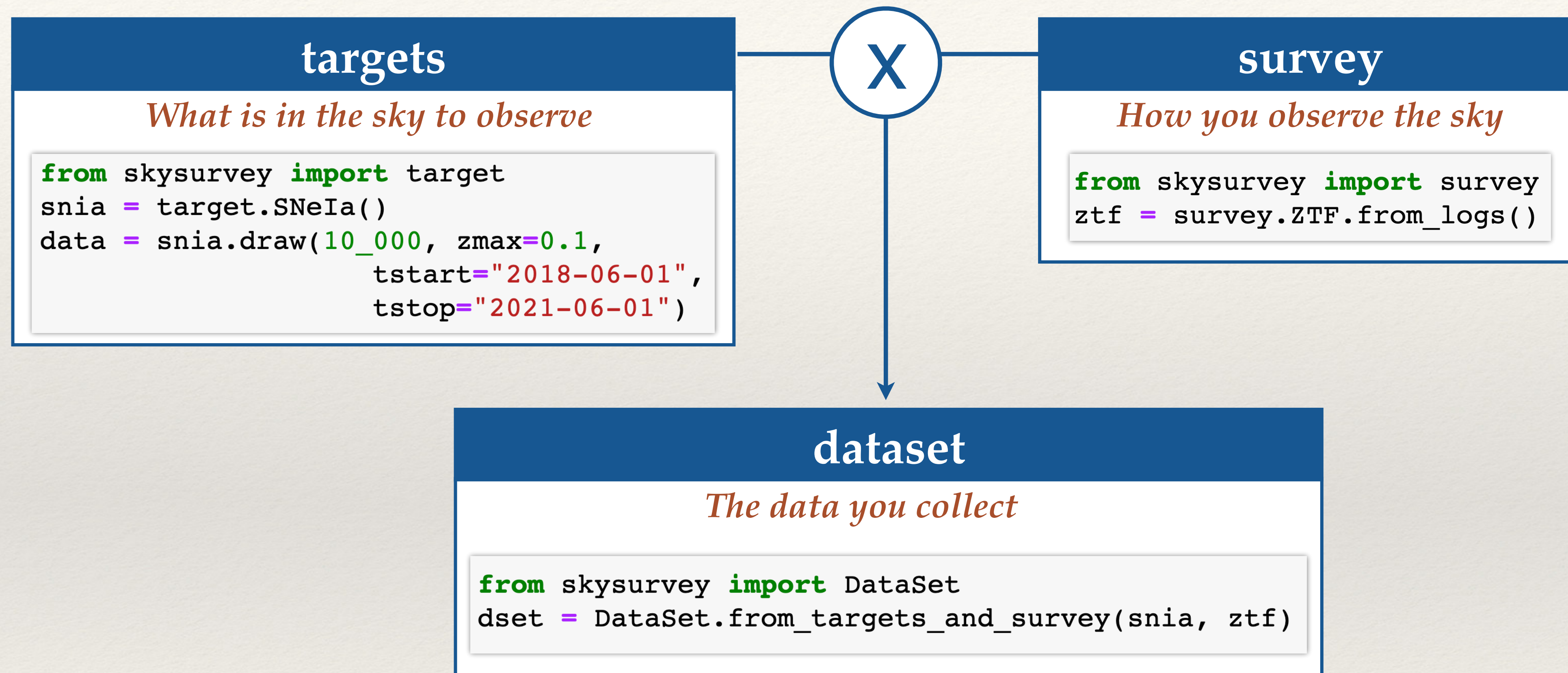
`pip install` **skysurvey**

Fast python package to simulate targets observed by a survey

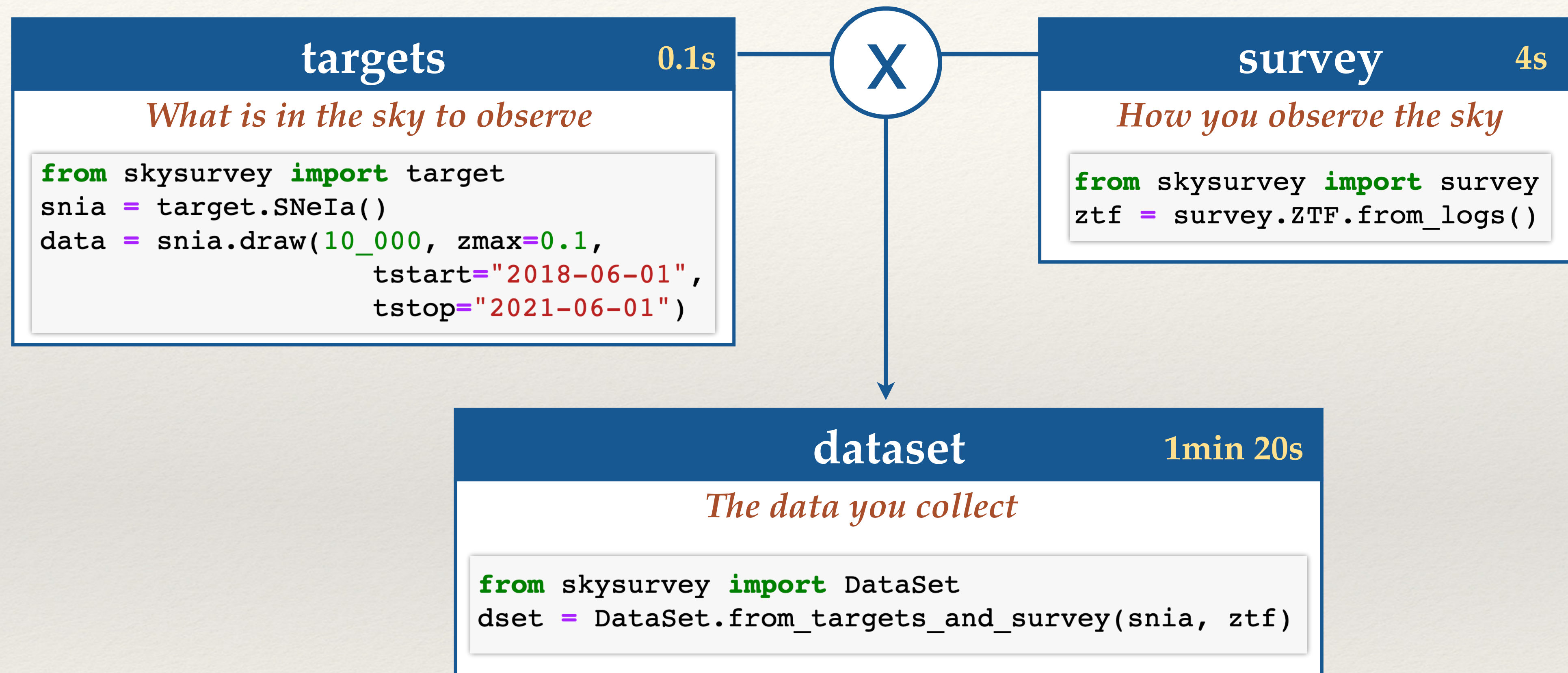
skysurvey *concept* | *similar to simsurvey (or SNANA)*



skysurvey | *easy*



skysurvey | *easy & fast*



skysurvey | *easy & very fast*

targets

0.1s

```
from skysurvey import target
snia = target.SNeIa()
data = snia.draw(10_000, zmax=0.1,
                tstart="2018-06-01",
                tstop="2021-06-01")
```

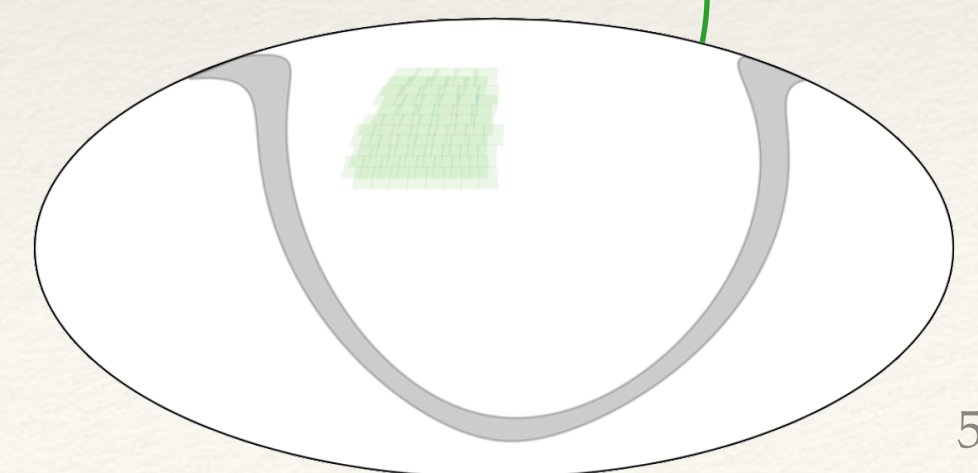
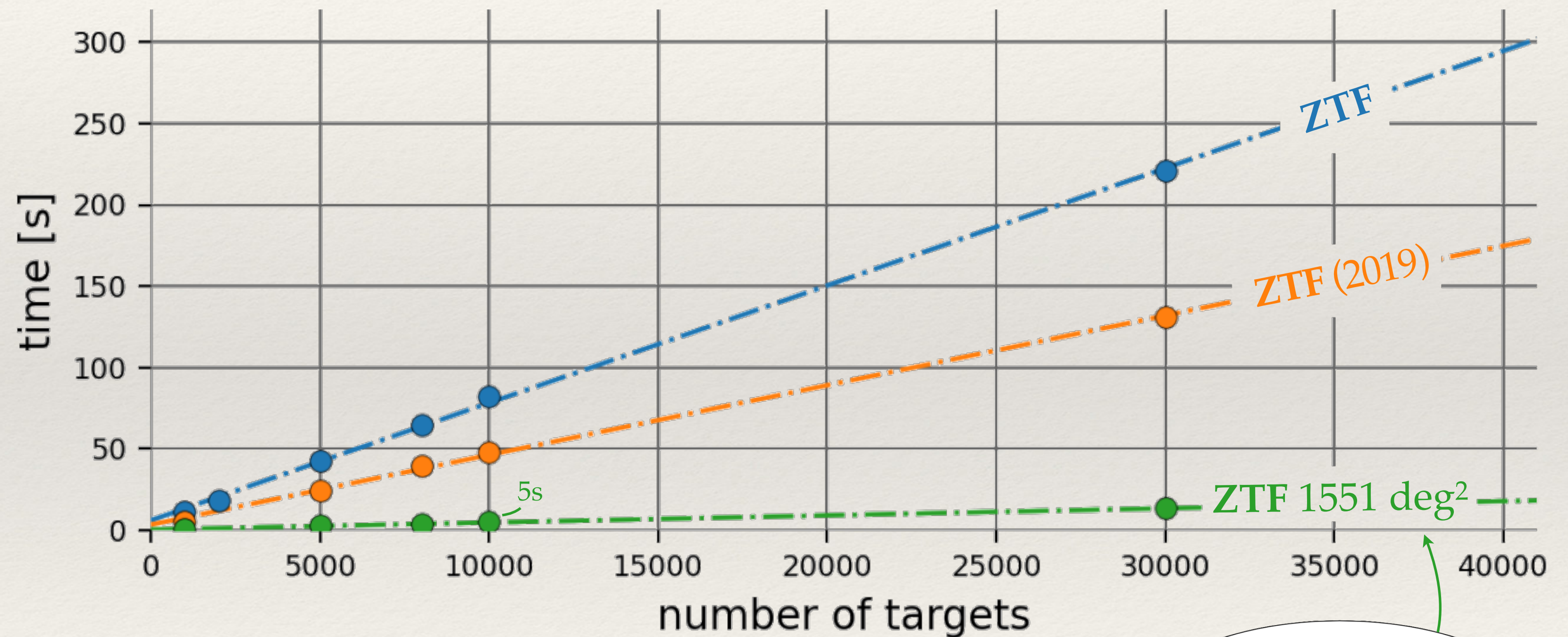
survey

4s

```
from skysurvey import survey
ztf = survey.ZTF.from_logs()
```

dataset

```
from skysurvey import DataSet
dset = DataSet.from_targets_and_survey(snia, ztf)
```



skysurvey | *dataset.data*

```
from skysurvey import DataSet
dset = DataSet.from_targets_and_survey(snia, ztf)
```

dataset.data | a pandas.DataFrame

dset.data

	fieldid	rcid	time	band	flux	fluxerr	zp	zpsys	
index									
1180	26008830	200	59	59104.390625	ztf	-31.013598	45.167931	25.247835	ab
	26141509	200	59	59108.355469	ztf	22.818803	20.157175	25.219229	ab
	26143939	200	59	59108.375000	ztf	-29.945615	39.831775	25.583187	ab
	26187803	200	59	59109.335938	ztf	41.691821	18.039705	25.138746	ab
	26193120	200	59	59109.375000	ztf	-73.439297	59.487999	25.339029	ab
...	...	...	...	...	...	...	...	...	
709	30211660	1875	29	59203.179688	ztf	-74.339908	65.528571	26.256800	ab
	30211719	1875	29	59203.179688	ztf	60.619083	61.211099	26.249039	ab
	30841208	1875	29	59221.167969	ztf	4.688963	31.552250	26.192867	ab
	36571558	1875	29	59392.414062	ztf	19.640033	43.115147	26.221598	ab
	36571618	1875	29	59392.414062	ztf	-54.984449	48.286923	26.223068	ab

5623030 rows × 8 columns

dset.data.groupby()

```
%%time
ndetection = dset.get_ndetection(per_band=True)
ndetection.head(5)
```

CPU times: user 337 ms, sys: 87.9 ms, total: 425 ms
Wall time: 412 ms

```
index band
0      ztfg      7
      ztfi      0
      ztfr     22
1      ztfg      0
      ztfi      0
```

Select targets detected 5 times in each band

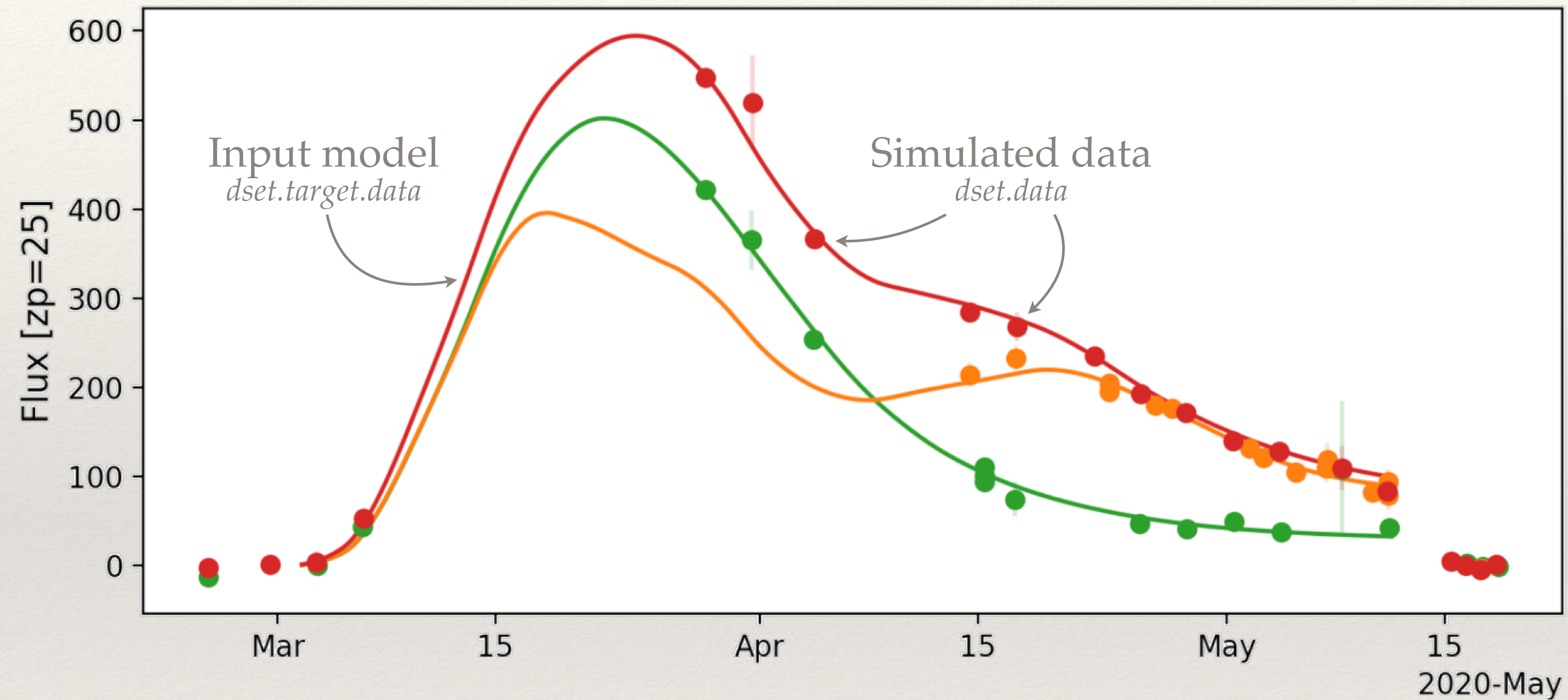
```
%%time
# get targets detected at least 5 times in all bands
ndetection = dset.get_ndetection(per_band=True)
nband_5points = (ndetection>=5).groupby(level=0).sum()
allbands = nband_5points[nband_5points==3]
allbands.index
```

CPU times: user 338 ms, sys: 92.9 ms, total: 431 ms
Wall time: 422 ms

```
Index([ 25,  26,  55,  58,  59,  66,  75,  93,  94,  98,
        ...
        4933, 4939, 4940, 4950, 4968, 4971, 4976, 4985, 4995, 4997]
      dtype='int64', name='index', length=796)
```

skysurvey | *dataset.targets*

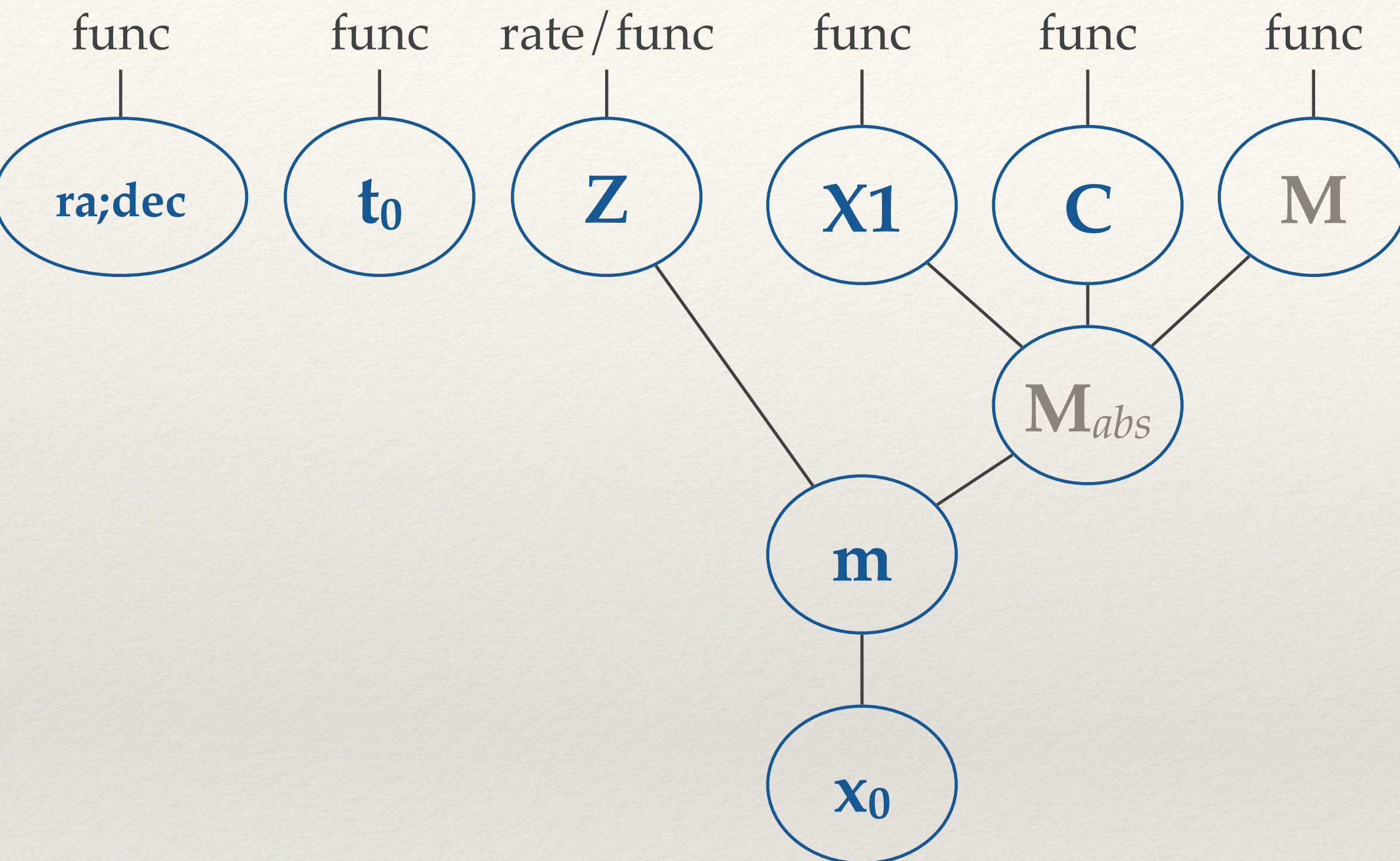
```
fig = dset.show_target_lightcurve(index=4995, phase_window=[-30,60])
```



```
dset.get_target_lightcurve(4995, detection_only=False)
```

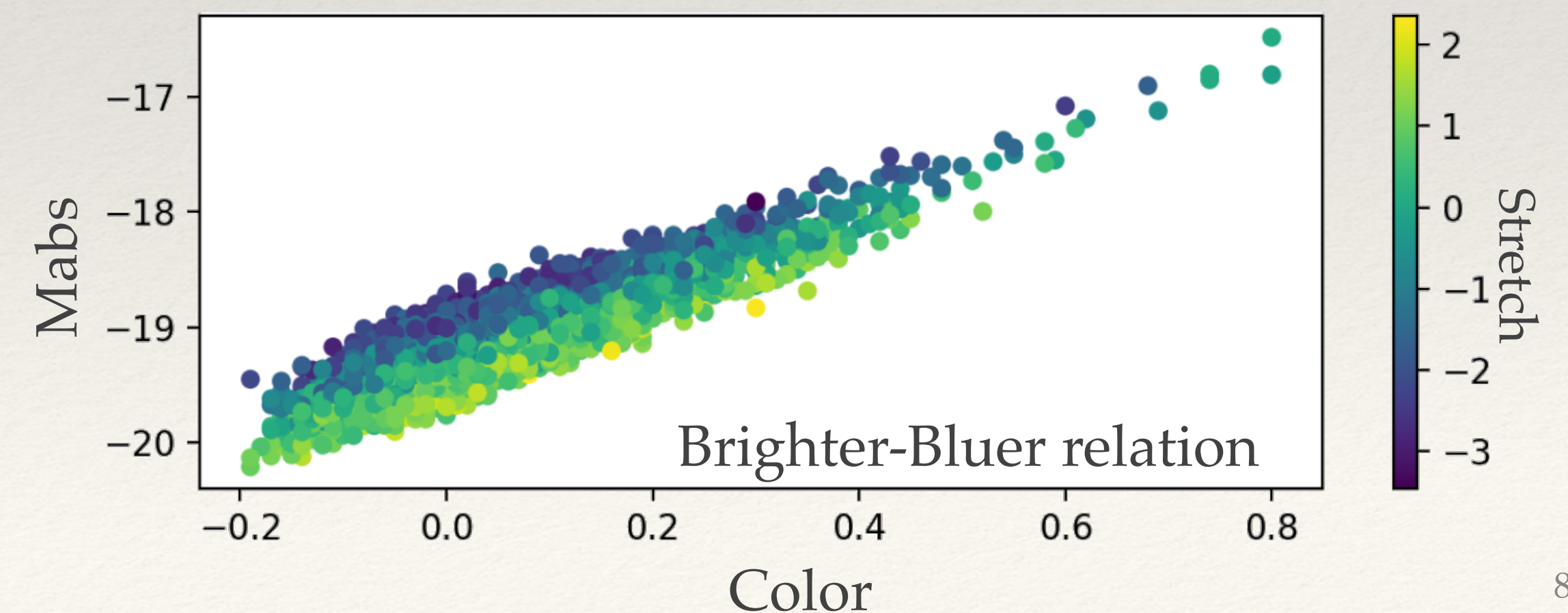
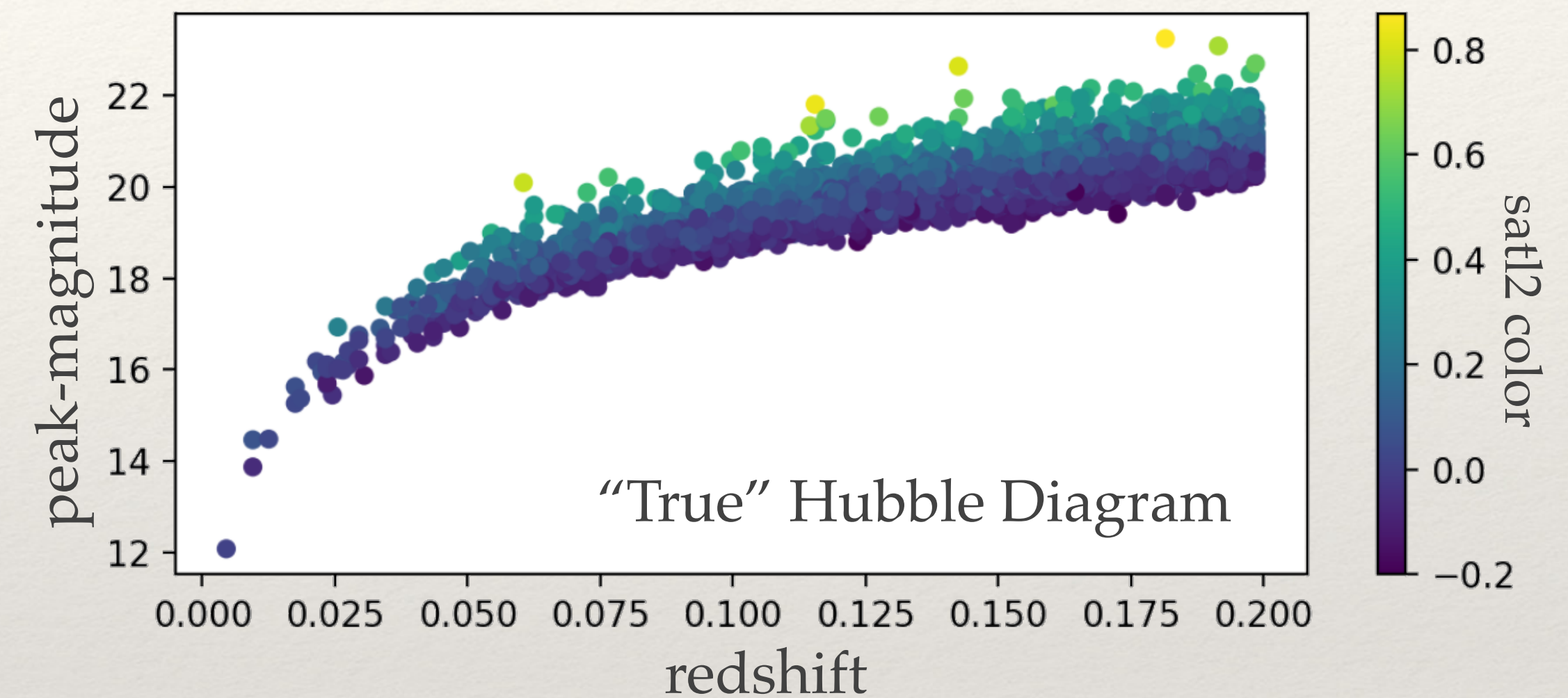
	fieldid	rcid	time	band	flux	fluxerr	zp	zpsys
725	633	62	58288.175781	ztfi	24.797387	23.846795	25.532640	ab
15438	633	62	58288.289062	ztfr	-5.423322	13.900481	26.210585	ab

Targets | *graph model (flexible & accurate)*

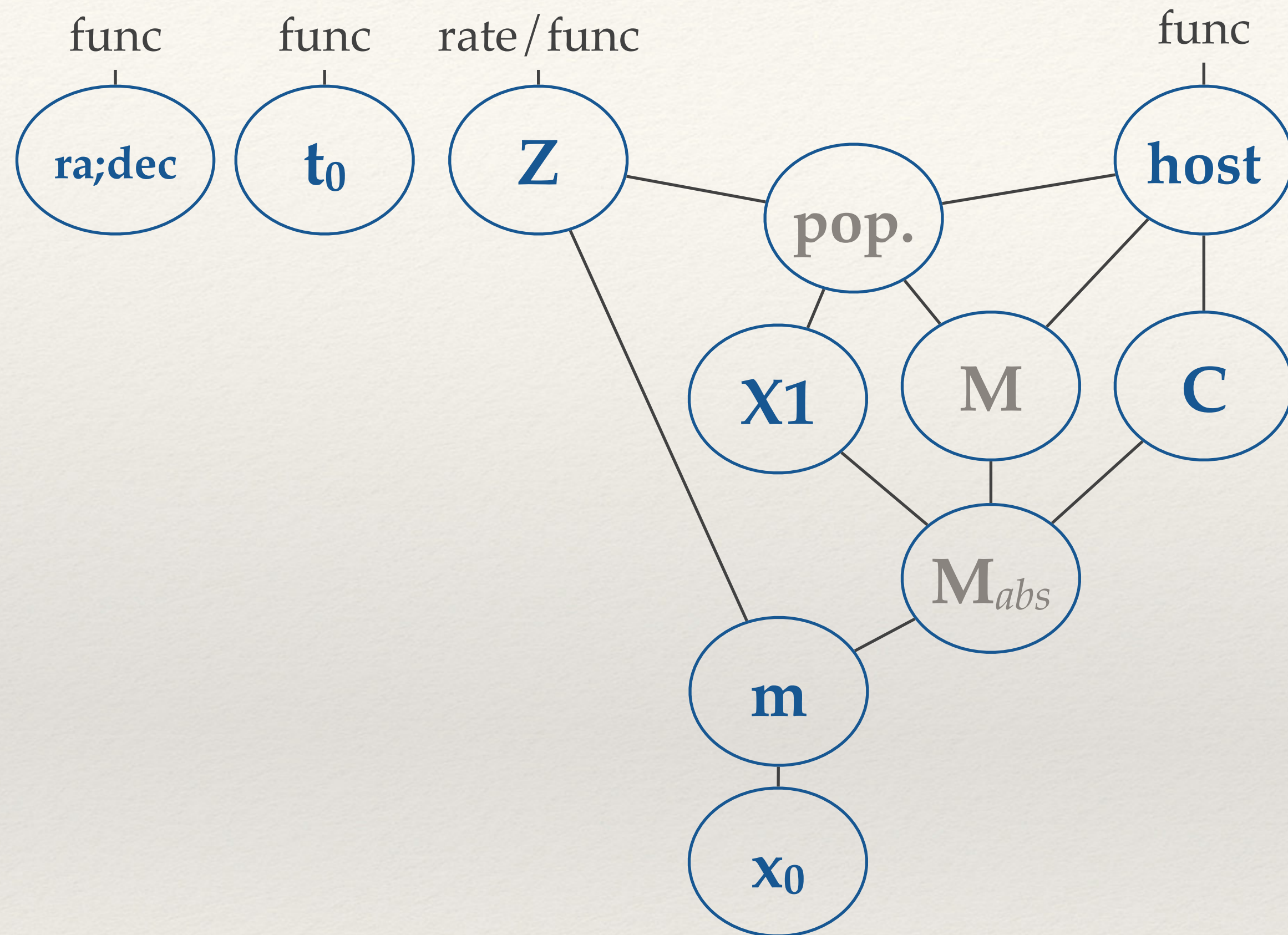


z	x1	c	t0	magabs	magobs	x0	ra	dec	template
0.0905	0.75	1.000000e-02	56116.421875	-19.406012	18.750700	0.000502	248.592468	-23.339365	salt2

```
from skysurvey import target
snia = target.SNeIa.from_draw(5_000)
_ = snia.show_scatter("z", "magobs", ckey="c", s=20)
```



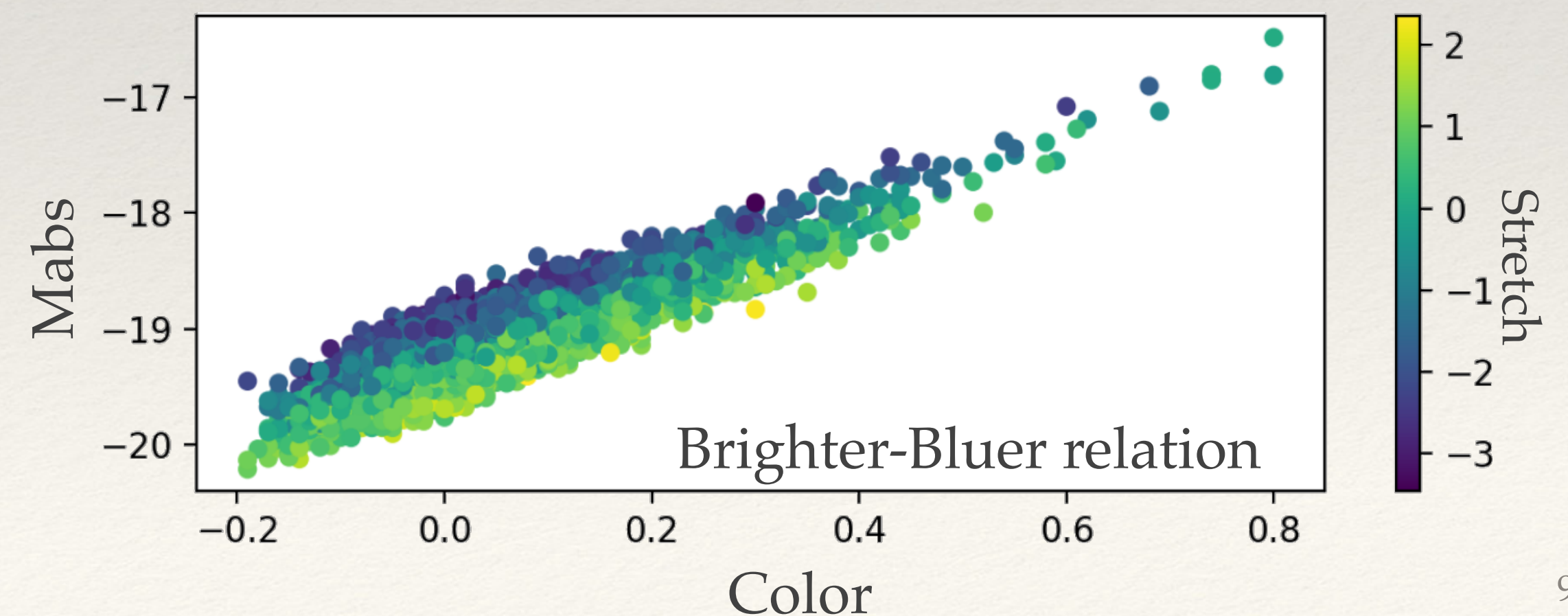
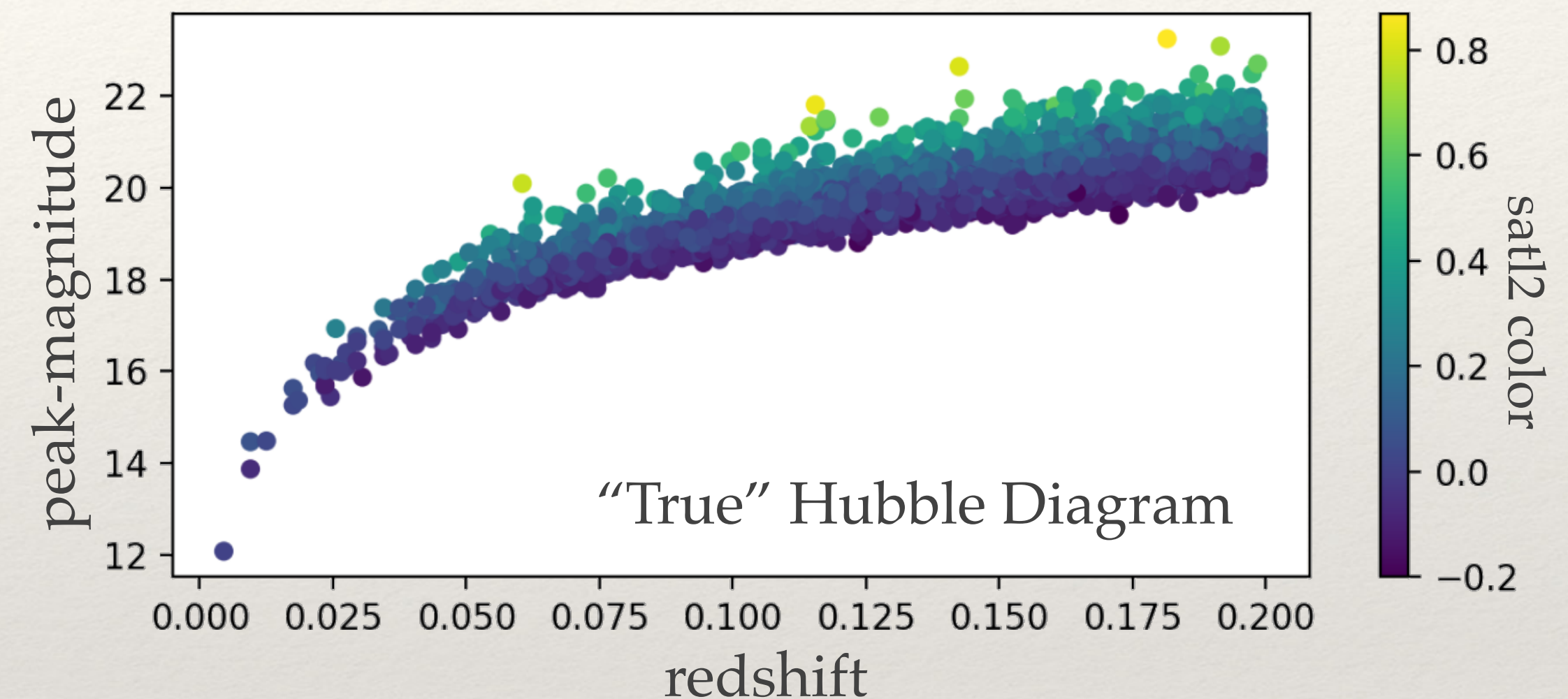
Targets | *graph model (easy to complexity)*



z	x1	c	t0	magabs	magobs	x0	ra	dec	template
0.0905	0.75	1.000000e-02	56116.421875	-19.406012	18.750700	0.000502	248.592468	-23.339365	salt2

easy & flexible.
Only based on dict ([see tutorial](#))

```
from skysurvey import target
snia = target.SNeIa.from_draw(5_000)
_ = snia.show_scatter("z", "magobs", ckey="c", s=20)
```



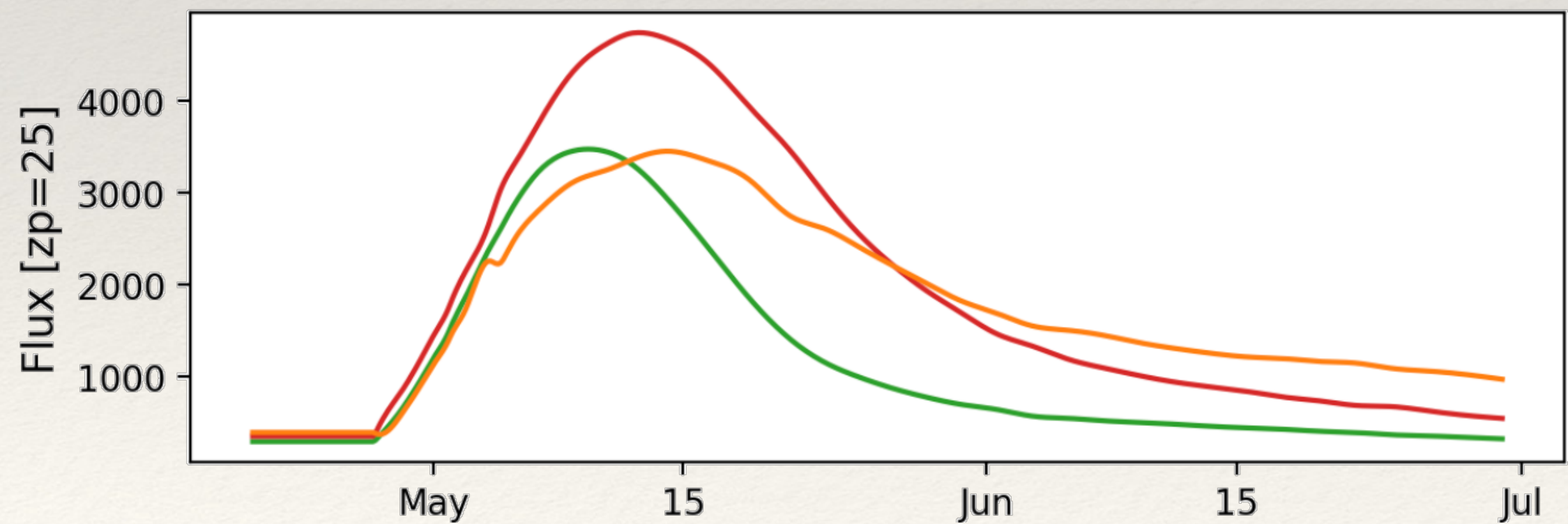
Targets | *any sncosmo source*

Example: a SNIc

```
from skysurvey import target
snic_v192004fe = target.TSTransient.from_sncosmo("v19-2004fe-corr")
data = snic_v192004fe.draw(5_000)
data
```

	z	t0	magabs	magobs	amplitude	ra	dec	template
0	0.0475	57158.300781	-18.637964	18.054295	8.242046e-15	288.741211	29.535795	v19-2004fe-corr
1	0.0445	57233.542969	-18.110306	18.435619	5.801034e-15	194.804916	39.676357	v19-2004fe-corr

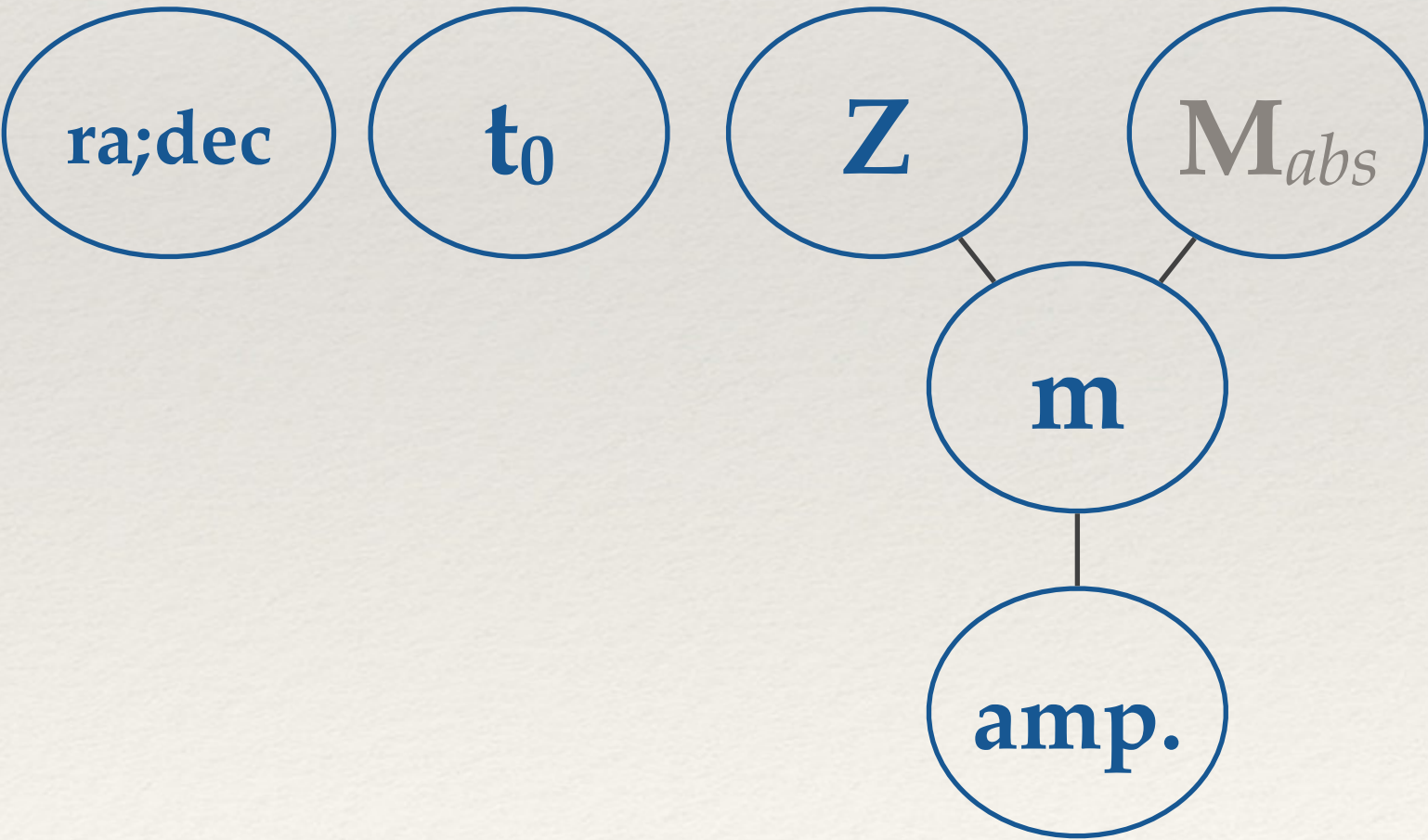
```
fig = snic_v192004fe.show_lightcurve(["ztfz","ztfz","ztfz"], index=10)
```



any sncosmo model is available

'v19-2004et'	'1.0'	SN II	TimeSeriesSource
'v19-2004fe-corr'	'1.0'	SN Ic	TimeSeriesSource
'v19-2004fe'	'1.0'	SN Ic	TimeSeriesSource
'v19-2004gq-corr'	'1.0'	SN Ib	TimeSeriesSource

Default TSTransient model



Targets | *multi-source Transient*

SNII | SNI Ib | SNIIn | SNIb | SNIc | SNIcBL

23

12

6

12

7

6

Vincenzi+2019

Example: SNII

```
from skysurvey import target
snii = target.SNeII()
data = snii.draw(5_000)
data
```

Trivial to create more

	template	z	t0	magabs	magobs	amplitude	ra	dec
0	v19-2013by-corr	0.0235	56141.894933	-16.390394	18.735831	1.327870e-15	83.182600	-81.571982
1	v19-2009dd-corr	0.0425	57440.797487	-16.775250	19.667698	2.309913e-15	351.097410	-34.964427
2	v19-2013fs-corr	0.0335	56914.999307	-16.262897	19.649169	1.036110e-15	16.600416	-13.591348

Targets | *multi-target as dataset input*

SNIa | SNII | SNI Ib | SNI In | SNI b | SNI c | SNI cBL | Any {TimeSeries}

Define a complex sky

```
from skysurvey import target
snii = target.SNeII.from_draw(size=5_000, tstart="2018-03-10", tstop="2022-01-01")
snia = target.SNeIa.from_draw(size=5_000, tstart="2018-03-10", tstop="2022-01-01")
snic = target.SNeIc.from_draw(size=1_000, tstart="2018-03-10", tstop="2022-01-01")

target_col = target.TargetCollection([snii, snia, snic])
```

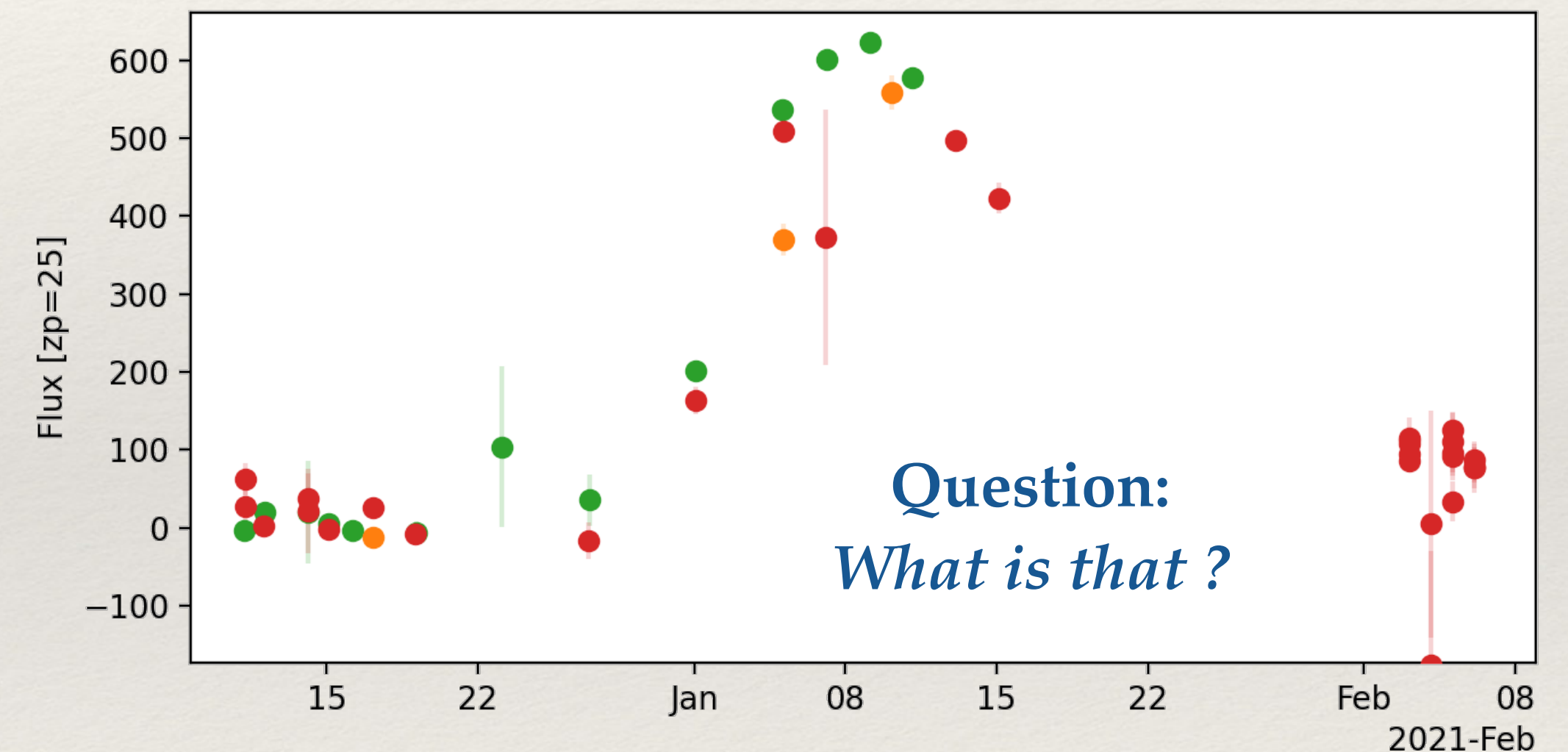
and simulate it

```
from skysurvey import DataSet
dset = DataSet.from_targets_and_survey(target_col, ztf)
```

```
target_col.data.sample(5)
```

	kind	subindex	template	z	t0	magabs	magobs	amplitude	ra	dec	x1	c	x0
9019	SN Ia	4019	salt2	0.1355	58783.839844	-18.826347	20.270363	NaN	287.602417	12.435346	-0.20	0.07	0.000124
3675	SN II	3675	v19-1987a-corr	0.0245	58842.530809	-18.241289	16.977034	2.674363e-13	324.488060	17.701776	NaN	NaN	NaN
3626	SN II	3626	v19-2012aw-corr	0.0375	58652.498253	-15.453630	20.709686	6.421395e-16	22.511193	-5.216683	NaN	NaN	NaN
6857	SN Ia	1857	salt2	0.1885	58984.328125	-19.403175	20.480267	NaN	47.713749	50.146709	-0.75	-0.03	0.000102
10585	SN Ic	585	v19-2004aw-corr	0.0155	58758.655448	-18.162327	16.047282	2.872998e-14	160.766830	22.914472	NaN	NaN	NaN

```
fig = dset.show_target_lightcurve(index=10436, phase_window=[-30,40], show_truth=False)
```



`pip install` skysurvey

survey

```
from skysurvey import survey
ztf = survey.ZTF.from_logs()
```

targets

```
from skysurvey import target
snii = target.SNeII.from_draw(size=5_000, tstart="2018-03-10", tstop="2022-01-01")
snia = target.SNeIa.from_draw(size=5_000, tstart="2018-03-10", tstop="2022-01-01")
snic = target.SNeIc.from_draw(size=1_000, tstart="2018-03-10", tstop="2022-01-01")

target_col = target.TargetCollection([snii, snia, snic])
```

dataset = targets x survey

```
from skysurvey import DataSet
dset = DataSet.from_targets_and_survey(target_col, ztf)
```

