## Transient and Variable Classification Alerts for ELAsTiCC

### **Rob Knop, LBNL & the ELAsTiCC Team** The Transient and Variable Universe 2023 2023-06-20

https://portal.nersc.gov/cfs/lsst/DESC\_TD\_PUBLIC/ELASTICC/

https://desc-tom.lbl.gov

https://desc-tom-2.lbl.gov (temporary)





elasticc.v0\_9\_1.alert.avsc

# Outgoing alerts (ingested by brokers):

- One alert for each detection (S/N>5).
- Includes all previous detections and all previous forced photometry\*.
- May include photo-z information on one or two possible host galaxies.

elasticc.v0\_9\_1.brokerClassification.avsc

**Incoming alerts** (produced by brokers):

- DiaSourceId
- Classifier identification
- Array of object class & probability

Alert schema: https://github.com/LSSTDESC/elasticc/tree/elasticc2/alert\_schema



Alerts Sent (One day in the last week of ELAsTiCC)

### Received — ALeRCE

Received — ANTARES

## Received — Fink

### **Turnaround time — first week of ELAsTiCC**



la	1.0% 13393	29.0% 490432	10.0% 165706	27.0% 455702	2.0% 28356	0.0% 702	0.0% 50	0.0% 86	0.0% 71	0.0% 55	14.0% 231881	3.0% 52497	0.0% 7253	0.0% 4498	13.0% 219322	0.0% 9	0.0%	0.0% 25	0.0%	2.0% 40621	n	
lb/c	- 2.0% 6228	12.0% 42022	32.0% 112642	14.0% 50171	3.0% 10295	0.0% 780	0.0% 53	0.0% 34	0.0% 12	0.0% 30	12.0% 43826	3.0% 12091	1.0% 2077	2.0% 7175	13.0% 44901	0.0% 1	0.0%	0.0%	U3 6	6.0% 22281		_
П	2.0% 32592	5.0% 97607	6.0% 108315	40.0% 720939	2.0% 35617	0.0% 1205	0.0% 161	0.0% 92	0.0% 34	0.0% 87	14.0% 250882	17.0% 295909	1.0% 13508	15763	6.0% 104631	0.0%	0.0% 9	0.0% 32	<b>00</b> 34	6.0% 104174	ng	at
lax	- 1.0% 684	14.0% 6716	5.0% 2250	20.0% 9461	12.0% 5691	0.0% 60	0.0% 8	0.0% 1	0.0% 0	0.0% 5	12.0% 5664	13.0% 6445	0.0%	<b>a</b> s 629	<b>U</b> .0% 8237			<b>5.1.1</b>		<b>at</b> 1995	ION	
91bg	- 3.0% 1059	4.0% 1488	35.0% 13811	6.0% 2326	5.0% 1852	8.0% 2989	0.0% 50	0.0% 6	0.0% 2	0.0% 3	7.0% 2927	3.0% 1192	1.0% 207	2.0% 653	18.0% 6902	0.0% 0	0.0% 0	0.0% 2	0.0% 0	9.0% 3676		
KN	- 2.0% 1	0.0% 0	10.0% 5	10.0% 5	4.0% 2	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	12.0% 6	12.0% 6	6.0% 3	0.0% 0	10.0% 5	0.0% 0	0.0% 0	0.0% 0	0.0% 0	31.0% 15		
M-dwarf Flare	- 0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	39.0% 514	5.0% 68	23.0% 303	0.0% 6	0.0% 0	0.0% 0	0.0% 0	0.0% 0	5.0% 66	5.0% 72	11.0% 141	11.0% 151	0.0% 0		
<b>I</b> Dwarf Nova	- 0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 9	81.0% 2330	9.0% 262	0.0% 1	0.0% 1	0.0% 0	0.0% 0	0.0%	2.0% 55	4.0% 107	2.0% 65	1.0% 35	0.0% 0		
ULens	- 0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 1	2.0% 43	94.0% 1690	0.0% 3	0.0% 0	0.0% 0	0.0%	0.0% 0	1.0% 11	2.0% 27	1.0% 15	0.0% 8	0.0% 0		
SLSN	- 0.0% 53	0.0% 155	2.0% 542	8.0% 2628	1.0% 400	0.0% 10	0.0% 1	0.0% 0	0.0% 7	1.0% 292	67.0% 22835	2.0% 686	0.0% 87	6.0% 1971	13.0% 4341	0.0% 0	0.0% 0	0.0% 5	0.0% 26	1.0% 184		
C TDE	- 0.0% 12	0.0% 50	0.0% 16	4.0% 638	1.0% 91	0.0% 9	0.0% 0	0.0% 0	0.0% 0	0.0% 0	6.0% 862	80.0% 11658	0.0% 20	0.0% 8	2.0% 359	0.0% 0	0.0% 0	0.0% 0	0.0% 0	5.0% 768		
П	- 0.0% 5	1.0% 8	1.0% 15	9.0% 106	3.0% 31	1.0% 6	0.0% 1	0.0% 0	0.0% 0	0.0% 1	21.0% 242	16.0% 186	8.0% 97	0.0% 5	30.0% 352	0.0% 0	0.0% 0	0.0% 0	0.0% 0	10.0% 122		
CART	- 1.0% - 114	3.0% 291	5.0% 428	20.0% 1810	6.0% 514	0.0% 23	0.0% 3	0.0% 0	0.0% 1	0.0% 0	20.0% 1800	19.0% 1716	1.0% 54	5.0% 445	13.0% 1160	0.0% 0	0.0% 0	0.0% 1	0.0% 0	7.0% 586		
PISN	- 0.0%	0.0% 0	1.0% 2	1.0% 3	0.0% 0	0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	17.0% 60	1.0% 3	1.0% 4	0.0% 1	79.0% 275	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 1		
Cepheid	- 0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.0% 9	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0%	97.0% 1226	0.0% 3	2.0% 28	0.0% 2	0.0% 0		
RR Lyrae	- 0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 1	0.0% 5	0.0% 115	0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0%	0.0% 106	92.0% 43070	6.0% 2983	1.0% 408	0.0% 0		
De <b>l</b> ta Scuti	_ 0.0% 0	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 2	0.0% 19	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.0% 203	2.0% 140	95.0% 8401	1.0% 48	0.0% 0		
EB	_ 0.0% 0	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 6	0.0% 10	1.0% 1299	0.0% 97	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 85	2.0% 1749	3.0% 3003	94.0% 102389	0.0% 0		
AGN	_ 0.0% _ 54	0.0% 188	0.0% 146	0.0% 193	1.0% 574	1.0% 600	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 79	4.0% 3806	0.0% 192	0.0% 6	0.0% 2	0.0% 0	0.0% 1	0.0% 7	0.0% 22	94.0% 90370		
	Other -	<u>a</u>	lb/c -	=	lax -	91bg -	- KN	Jare -	Nova -	ens -				CART -	PISN -	pheid -	Lyrae -	Scuti -	EB -	AGN -		
	SN-like/							Np-W			LE	u		<b>a</b> 5	3	ů	RR	Delta				

Predicted class

la -	1.0% 13393	29.0% 490432	10.2% 165700	27.0% 455702	2.0% 28356	0.0% 702	0.0% 50	0.0% 86	0.0% 71	0.0% 55	14.0% 231881	3.0% 52497	0.0% 7253	0.0% 4498	13.0% 219322	0.0%	0.0% 13	0.0% 25	0.0% 10	2.0% 40621	6	
lb/c -	2.0% 6228	13.0% 42022	32.0% 112642	14.0% 50171	3.0% 10295	0.0%	0.0%	0.0% 34	0.0% 12	0.0% 30	12.0% 43826	3.0% 12091	1.0% 2077	2.0% 7175	13.0% 44901	0.0% 1	0.0% 7	0.0% 5		6.0% 22281		-
II -	2.0% 32592	5.0% 97607	100% 100215	40.0% 720939	2.0% 35617	0.0% 1205	0.0% 161	0.0% 92	0.0% 34	0.0% 87	14.0% 250882	17.0% 295909	1.0% 13508	1.5763	6.0% 104631	7	0.0% 9	0.0% 32	<b>DOO</b> 34	6.0% 104174	ng	at
lax -	1.0% 684	14.0% 6716	5.0% 2250	20.0% 9451	12.0% 5691	0.0) 60	0.0% 8	0.0% 1	0.0% 0	0.0% 5	12.0% 5664	13.0% 6445	0.0% 232	<b>a</b> .s	8237			<b>5.</b>		<b>a</b> 1995	on	
91bg -	3.0% 1059	4.0% 1488	35.0% 13811	6.0% 2326	5.0% 1859	8.0% 2989	0.0% 50	0.0%	0.0%	0.0% 3	7.0% 2927	3.0% 1192	1.0% 207	2.0% 653	18.0% 6902	0.0% 0	0.0% 0	0.0% 2	0.0% 0	9.0% 3676		
KN -	2.0% 1	0.0% 0	10.0% 5	10.0% 5	4.0% 2	0.0% 0	0.0% 0	0.0% 0	0.0%	0.0% 0	12.0% 6	12.0%	6.0% 3	0.0%	10.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	31.0% 15		
M-dwarf Flare -	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	39.0% 514	5.0% 68	23.0% 303	0.0% 6	0.0% 0	0.0% 0	0.0%	0.0%	5.0% 66	5.0% 72	11.0% 141	11.0% 151	0.0% 0		
<b>IV</b> Dwarf Nova -	0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 9	81.0% 2330	9.0% 262	0.0% 1	0.0% 1	0.0% 0	0.0% 0	0.0% 0	2.0% 55	4.0% 107	2.0% 65	1.0% 35	0.0% 0		
ULens -	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 1	2.0% 43	94.0% 1690	0.0%	0.0% 0	0.0%	0.0%	0.0%	1.0% 11	2.0% 27	1.0% 15	0.0% 8	0.0% 0		
SLSN -	0.0% 53	0.0% 155	2.0% 542	8.0% 2628	1.0% 400	0.0% 10	0.0% 1	0.0% 0	0.0% 7	1.0% 292	67.0% 22835	.0% 586	0.0% 87	6.0% 1971	13.0% 4341	0.0% 0	0.0% 0	0.0% 5	0.0% 26	1.0% 184		
	0.0% 12	0.0% 50	0.0% 16	4.0% 638	1.0% 91	0.0% 9	0.0% 0	0.0% 0	0.0% 0	0.0% 0	6.0% 862	80.0% 11658	0.0% 20	0.0% 8	2.0% 359	0.0%	0.0% 0	0.0% 0	0.0% 0	5.0% 768		
Z ILOT -	0.0%	1.0% 8	1.0% 15	9.0% 106	3.0% 31	1.0% 6	0.0% 1	0.0% 0	0.0% 0	0.0% 1	21.0% 242	16.0% 186	8.0% 97	0.0%	30.0% 352	0.0% 0	0.0% 0	0.0% 0	0.0% 0	10.0% 122		
CART -	1.0% 114	3.0% 291	5.0% 428	20.0% 1810	6.0% 514	0.0% 23	0.0% 3	0.0% 0	0.0% 1	0.0% 0	20.0% 1800	19.0% 1716	1.09 54	5.0% 445	13.0% 116	0.0% 0	0.0% 0	0.0% 1	0.0% 0	7.0% 586		
PISN -	0.0%	0.0% 0	1.0% 2	1.0% 3	0.0% 0	0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	17.0% 60	1.0% 3	1.0% 4	9.0%	79.0% 275	0 0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 1		
Cepheid -	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.0% 9	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.90	97.0% 1226	0.0% 3	2.0 28	a <sub>ç</sub> ,	ab	le	
RR Lyrae -	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 1	0.0% 5	0.0% 115	0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 106	92.0% 43070	6.0% 2983	1.0% 408	<b>ita</b>	rs	
Delta Scuti -	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 2	0.0% 19	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.03 203	2.0% 140	95.0% 8401	1.0% 48	0.0% 0		
EB -	0.0%	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0%	0.0% 0	0.0% 6	0.0% 10	1.0% 1299	0.0% 97	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 85	2.0% 1749	3.0% 3003	94.0% 102389	0.0%		
AGN -	0.0% 54	0.0% 188	0.0% 146	0.0% 193	1.0% 574	1.0% 600	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 79	4.0% 3806	0.0% 192	0.0% 6	0.0% 2	0.0% 0	0.0% 1	0.0% 7	0.0% 22	94.0% 90370	) A	GN
	SN-like/Other -	<u>a</u>	lb/c -	=	lax -	91bg -	KN -	M-dware -	<b>B</b> <sup>MO</sup>	<b>ic</b>		ď		as	S	Cepheid -	RR Lyrae -	Delta Scuti -	B	AG		

la -	2.0% 17770	22.0% 206217	12.0% 117434	25.0% 235572	2.0% 17605	0.0% 626	0.0% 150	0.0% 73	0.0% 206	0.0% 136	18.0% 173583	4.0% 42156	0.0% 2569	1.0% 6058	10.0% 91010	0.0% 4	0.0%	0.0% 21	0.0% 14	5.0% 44585	0
lb/c -	2.0% 4196	11.0% 23579	25.0% 48888	17.0% 34302	2.0% 3382	0.0%	0.0%	0.0% 32	0.0% 65	0.0% 67	15.0% 29027	2.0% 4788	<b>) (1</b> 0.0% 958	1.0% 1868	15.0% 28563	0.0% 3	0.0%	0.0%		8.0% 16569	
II -	1.0% 11373	6.0% 48323	0% 52383	40.0% 342451	2.0% 16380	0.0% 716	0.0% 232	0.0% 187	0.0% 135	0.0% 122	17.0% 148376	11.0% 89452	1.0% 6492	1.0% 6558	7.0% 58134	0.0%	0.0% 16	0.0% 14	0.0% 16	8.0% 66719	three
lax -	2.0% 448	13.0% 3097	4.0% 1052	23.0% 53.7	9.0% 2119	0.0% 52	0.0% 7	0.0% 1	0.0% 2	0.0% 12	19.0% 4723	10.0% 2525	0.0% 87		<b>5</b> 3343			ns 1	0.0% 2	5.0% 1301	
91bg -	2.0% 507	5.0% 969	34.0% 7112	10.0% 2132	2.0% 488	4.0% 806	0.0% 64	0%	0.0%	0.0% 13	11.0% 2211	1.0% 283	0.0% 101	2.0% 385	14.0% 2827	0.0% 0	0.0% 0	0.0% 0	0.0% 0	13.0% 2732	
KN -	0.0% 0	0.0% 0	25.0% 2	25.0% 2	0.0% 0	0.0% 0	12.0% 1	0.0% 0	0.0% 0	0.0%	0.0% 0	0.0%	0.0%	0.0%	12.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	25.0% 2	
M-dwarf Flare -	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	13.0% 7	19.0% 10	23.0% 12	2.0% 1	0.0% 0	0.0%	0.0% 0	0.0% 0	2.0% 1	4.0% 2	25.0% 13	12.0% 6	0.0% 0	
Dwarf Nova -	0.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.0% 36	79.0% 1455	10.0% 189	0.0% 3	0.0%	0.0%	0.0% 0	0.0%	1.0% 21	4.0% 82	1.0% 24	2.0% 29	0.0% 0	
uLens -	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 3	7.0% 91	84.0% 1149	0.0%	0.0% 0	0.0% 0	0.0% 0	<b>ns</b>	1.0% 20	2.0% 33	2.0% 26	3.0% 35	0.0% 0	
SLSN -	0.0% 90	1.0% 175	2.0% 621	15.0% 3695	5.0% 1255	0.0% 19	0.0% 1	0.0% 0	0.0% 3	1.0% 241	53.0% 13295	0% /95	0.0% 74	3.0% 754	15.0% 3679	0.0% 0	0.0% 2	0.0% 1	0.0% 25	1.0% 177	
TDE -	0.0% 10	1.0% 89	0.0% 33	14.0% 1272	2.0% 186	0.0% 11	0.0% 1	0.0% 0	0.0% 1	0.0% 0	12.0% 1121	61.0% 5510	0.0% 29	0.0%	2.0% 170	0.0%	0.0% 0	0.0% 0	0.0% 0	6.0% 557	
ILOT -	0.0% 2	1.0% 10	3.0% 21	16.0% 108	3.0% 20	0.0% 1	0.0% 2	0.0% 0	0.0% 0	0.0% 0	20.0% 135	15.0% 105	4.0% 29	1.0%	26.0% 176	0.0% 0	0.0% 0	0.0% 0	0.0% 0	10.0% 69	
CART -	1.0% 47	4.0% 186	5.0% 224	24.0% 1072	6.0% 254	0.0% 21	0.0% 5	0.0% 0	0.0% 3	0.0% 4	24.0% 1069	12.0% 513	1.09 31	2.0% 108	13.0% 583	0.0% 0	0.0%	0.0% 0	0.0% 0	7.0% 332	
PISN -	0.0% 1	1.0% 3	1.0% 3	3.0% 8	2.0%	1.0% 2	0.0% 0	0.0% 0	0.0%	0.0%	29.0% 74	1.0% 3	1.0% 2	.0%	58.0% 146	00% D	0.0%	0.0%	0.0%	1.0% 2	
Cepheid -	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.0%	8.0%	0.0%	0.0%	0.0%	0.0%	0.90	62.0%	8.0%	12 87	ari	ab	le
RR Lyrae -	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%	12.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	33.0%	39.0% 13138	6.0%	<b>t</b> a	rs
Delta Scuti -	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	6.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0	21.0%	59.0%	5.0%	0.0%	
FB -	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	399	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	10.0%	80.0%	0.0%	
AGN	0	0	0 2.0%	0	0	0	0	77	1000	2640 0.0%	21 0.0%	12 5.0%	0 3.0%	0	0	152	3793	7429 0.0%	62208 0.0%	87.0%	AGN
AGN -	218 J	581 <u>e</u>	1392 - )q	259 <b>_</b>	289 	496 - 6q1	o Ż	are -		eus -	70	3531	1772	11 -	10	eid - 0	2 - ae	2 cuti -	45 	58172	/
	SN-like/Ot					6	ŀ	мр-м		IC.	te	a	CI	<b>a</b> S	S	Cept	RR Ly	Delta S		4	

# Classification as a function of time relative to lightcurve peak



Lots more at https://desc-tom.lbl.gov

#### Targets classified by brokers listening to the ELAsTiCC2 "plumbing test stream"



## TOM Photometry view of a (simulated) z=0.16 SN la





## Streaming to brokers near you, July 2023

# **Next Steps**

- Hook up to LSST prompt products database (PPDB) to pull photometry of objects we learn from brokers (simulated, sort of, in ELAsTiCC2).
- Process broker classifications to produce followup priority lists (for both hot transients and host galaxies). (RESSPECT workshop pre-DESC meeting, July 2023.)
- Define telescope communication (API/observation request) for follow-up (using TOM facilities et al.).
- Define telescope communication to pull information about what has been observed (and where available, data).
- Evolve from the current DESC TOM database structure to the DESC-FAST database.