Fast X-ray Transients

Einstein Probe & Swift

Peter Jonker

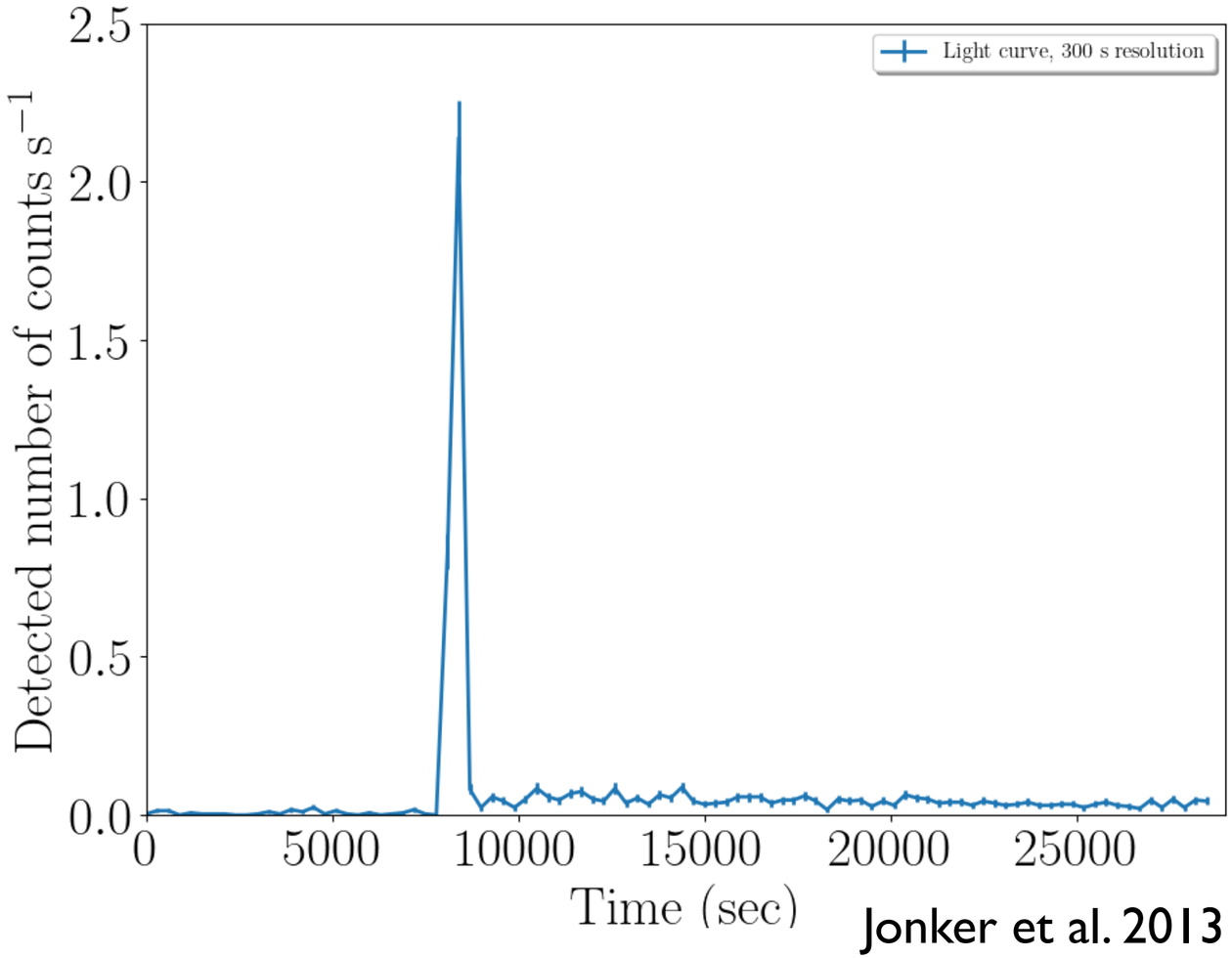
Andrew Levan, Daniele Malesani, Mery Ravasio, Jonathan Quirola-Vásquez, Franz Bauer, Joyce van Dalen, Agnes van Hoof, Javi Sierras Sánchez, Manuel Torres, Daniel Mata-Sánchez, Ashley Chrimes, Antonio Martin-Carrillo et al.

European Research Council
Established by the European Commission

Swift 20 yrs; Florence, March 2025

Radboud Universiteit

Fast X-ray Transients: What?



Jonker et al. 2013

- Extra-galactic origin
- Multiple origins
- Now enormous progress due to Tianguan/Einstein Probe (for more on EP see Weimin Yuan's talk Friday) & Swift

Einstein Probe FXT stats

98 EP FXTs

20 with a burst of gamma-rays: GRBs

37 extra-galactic with an optical CP

36 without an optical CP

22 with redshift

As of ~15 March, 2025

Einstein Probe FXT stats

98 EP FXTs

20 with a burst of gamma-rays: GRBs
e.g., Mery Ravasio's fast, dedicated Fermi/GBM searches

37 extra-galactic with an optical CP

36 without an optical CP

22 with redshift

As of ~15 March, 2025

Swift priority “0” follow-up

https://www.swift.ac.uk/EP/

Phil Evans

Swift-XRT data products for Einstein Probe follow-up

The table below lists all Einstein Probe triggers observed by Swift to date. Each field name links to the main XRT results page for that trigger.

About the analysis.

See talks Jimmy DeLaunay & Jamie Kennea

Name	Fields planned/ /processed	Uncatalogued sources (Total sources)	Counterpart candidates	Trigger time	Analysis Updated
EP#01709133021	1 / 1	1 (0)	0	2025-03-24 09:38:23	2025-03-24 20:46:45
EP250321a	1 / 1	12 (0)	1	2025-03-21 06:09:59	2025-03-22 10:06:45
EP J1616.7-3042	1 / 1	12 (0)	0	2025-03-20 23:15:22	2025-03-24 20:52:21
EP#01709132801	1 / 1	3 (1)	1	2025-03-16 07:30:48	2025-03-16 17:58:08
EP#01709132387	1 / 1	3 (0)	1	2025-03-07 18:51:20	2025-03-08 15:07:44
EP#01709132323	1 / 1	3 (0)	1	2025-03-06 09:04:17	2025-03-06 22:57:22
EP250304a	1 / 1	4 (6)	1	2025-03-04 01:32:30	2025-03-05 18:29:09
EP#01709132212	1 / 1	2 (0)	0	2025-03-03 16:00:13	2025-03-04 12:33:21
EP250302a	1 / 1	4 (0)	1	2025-03-02 15:36:04	2025-03-04 15:57:46
EP#01709132140	1 / 1	6 (0)	1	2025-03-02 01:37:56	2025-03-02 07:17:16

Swift FXT discoveries

https://www.swift.ac.uk/LSXPS/transients/

Home About Support Data Access Data Analysis GRB Products Publications Links site map | Search: ?

Home > Data Access > LSXPS Catalogue > Transients

All transients

Search | Documentation | Catalogue paper | Table descriptions | Download catalogue files | Upper limit server | Recent changes.

This table lists serendipitous transients or transient candidates found in the real-time analysis of XRT data.Transients have been classified into a series of broad categories by members of the XRT team, to aid selection. You can filter which categories are shown using the controls above the table and you can sort the table by clicking on column headers.

Show filters.

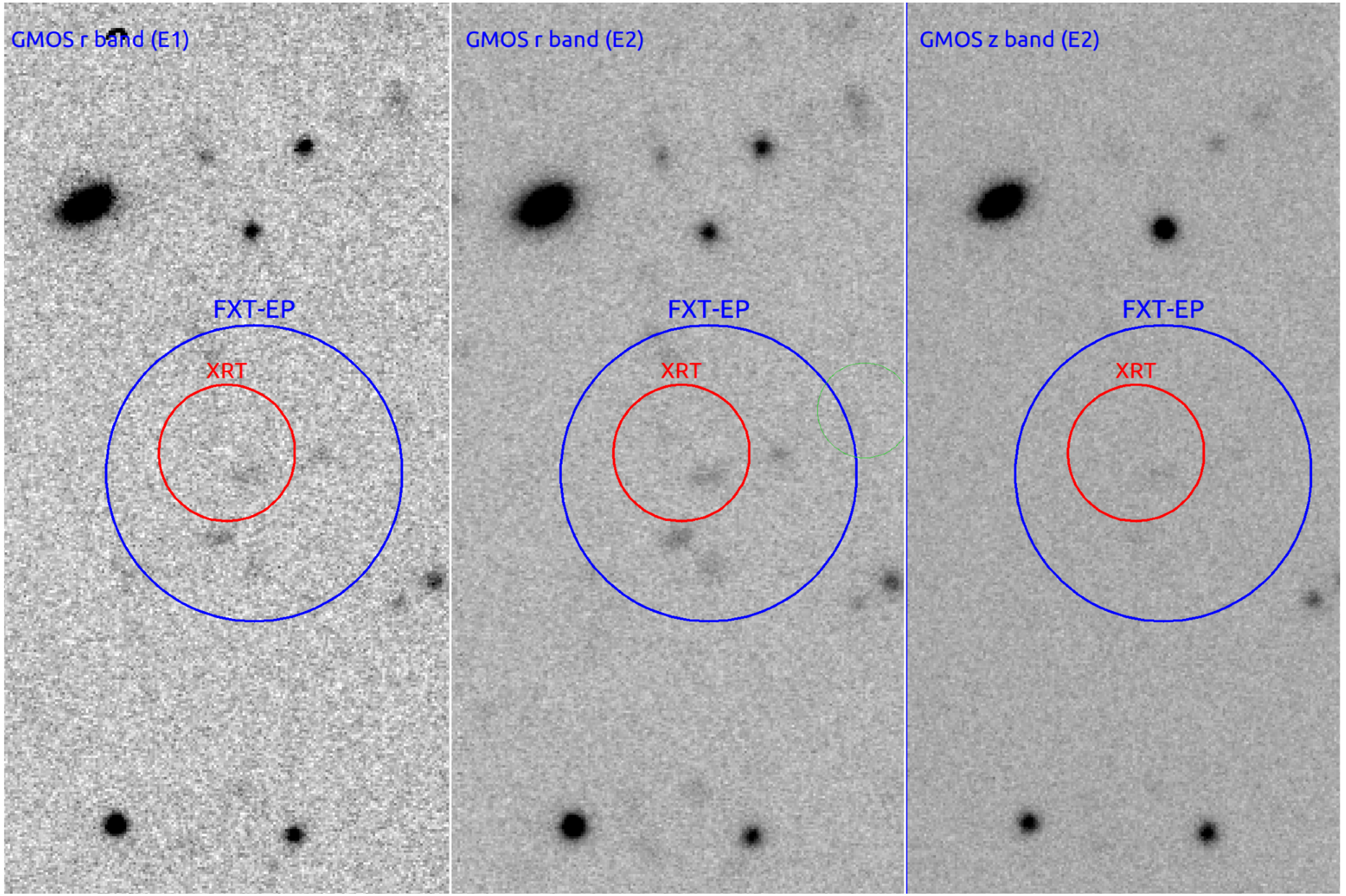
Coordinate format: Sexagesimal

See Poster Srivastava & Evans

Name	Date found (Discovery obs)	RA	Dec	Err_{90}	Classification
Swift J092237.2-074501	2025-03-24 08:03:33 (00019640001)	09h 22m 37.25s	-07° 45′ 00.9″	4.2	Confirmed transient
Swift J115627.2+171648	2025-03-23 13:41:52 (00019631004)	11h 56m 27.36s	+17° 16′ 48.3″	4.8	Confirmed transient
Swift J083610.3+420434	2025-03-11 12:09:48 (00019508008)	08h 36m 10.37s	+42° 04′ 33.3″	6.3	Confirmed transient
Swift J103332.9+282852	2025-03-08 07:08:00 (00019577001)	10h 33m 32.96s	+28° 28′ 52.3″	6.4	Confirmed transient
Swift J031834.4-691627	2025-02-23 13:55:22 (00092789005)	03h 18m 34.39s	-69° 16′ 26.5″	4.4	Confirmed transient
Swift J193041.0+382547	2025-02-13 06:08:53 (00091364005)	19h 30m 41.13s	+38° 25′ 46.3″	4.0	Confirmed transient
Swift J202124.0+372633	2025-01-15 20:24:15 (00090049005)	20h 21m 23.95s	+37° 26′ 33.6″	5.7	Confirmed transient
Swift J103738.0+403701	2024-10-23 02:33:36 (03112102015)	10h 37m 38.01s	+40° 37′ 00.4″	5.7	Confirmed transient
Swift J194311.8+210315	2024-08-22 22:59:02 (00016747006)	19h 43m 12.01s	+21° 03′ 15.2″	4.9	Confirmed transient

rsiteit

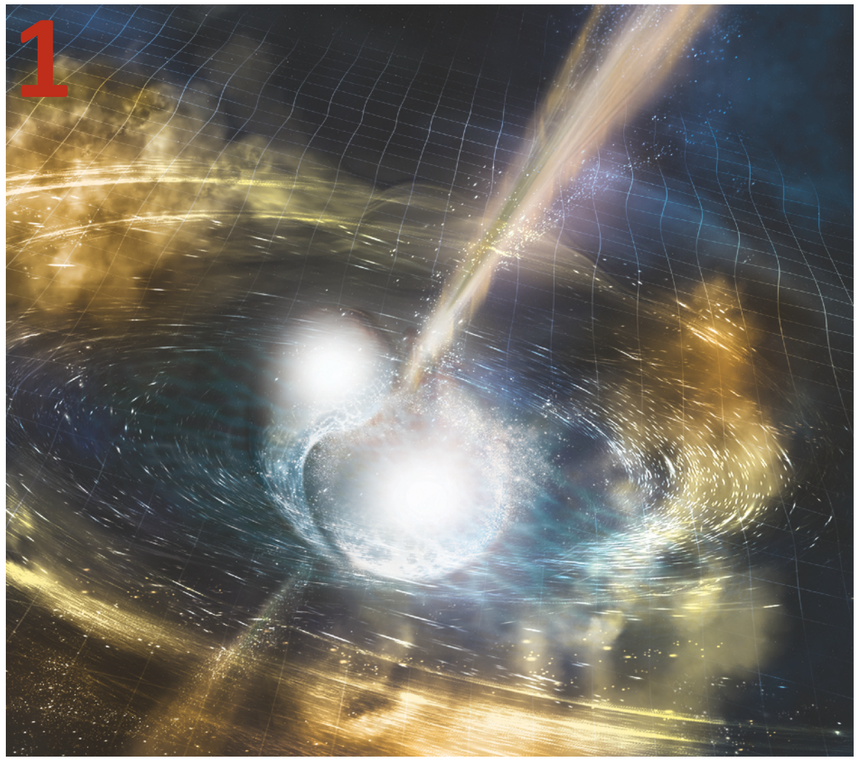
Swift's (and Chandra's!) role: Dark FXTs?



EP241103a

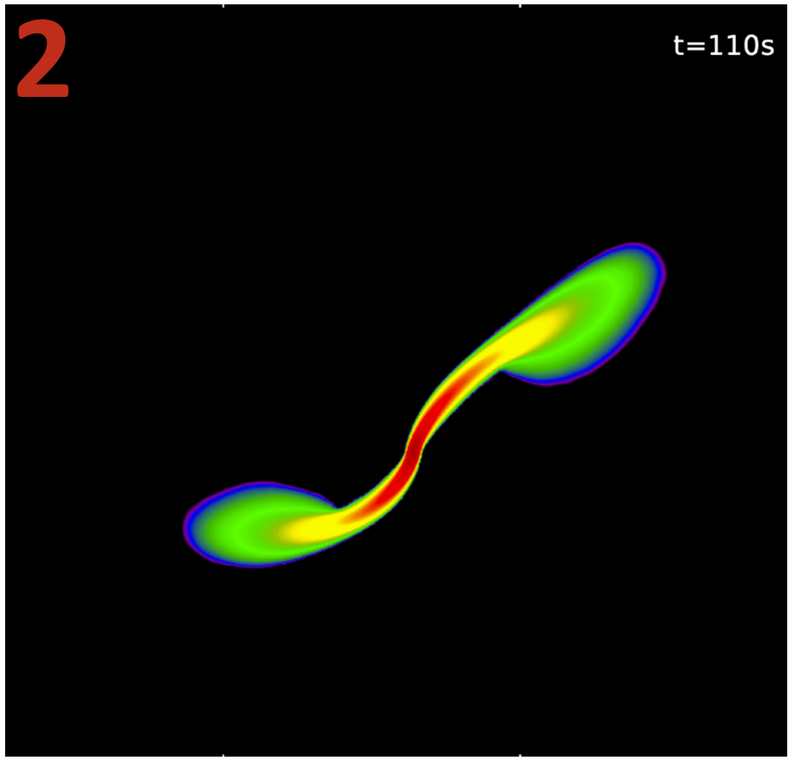
Jonker et al. 2024, GCN38063
Sierras Sanchez et al. in prep.

Fast X-ray transients: models



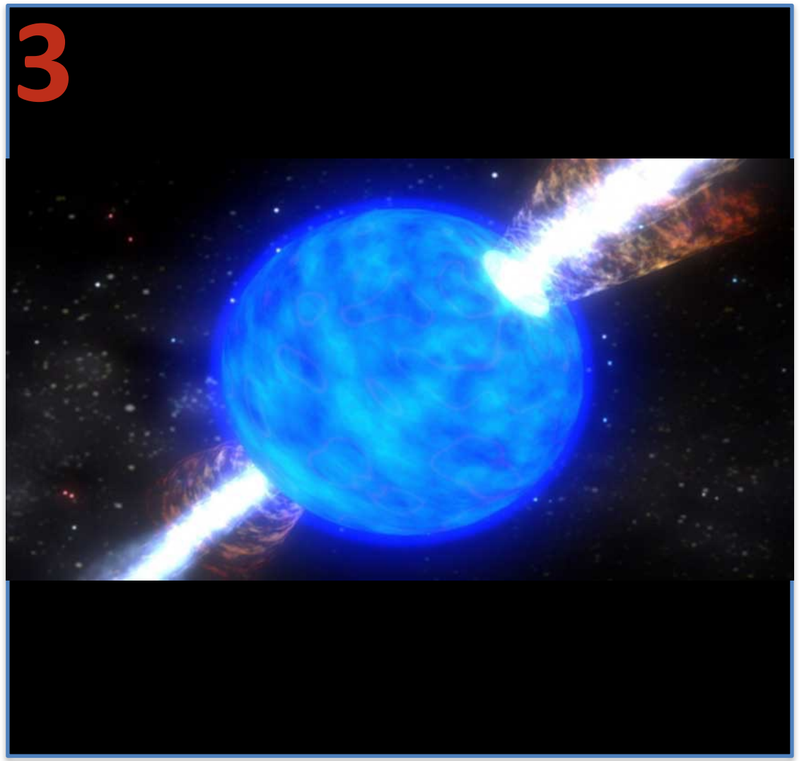
Binary neutron star merger

e.g., Metzger & Piro 2014



White dwarf tidal disruption event (jetted)

e.g., Jonker et al. 2013



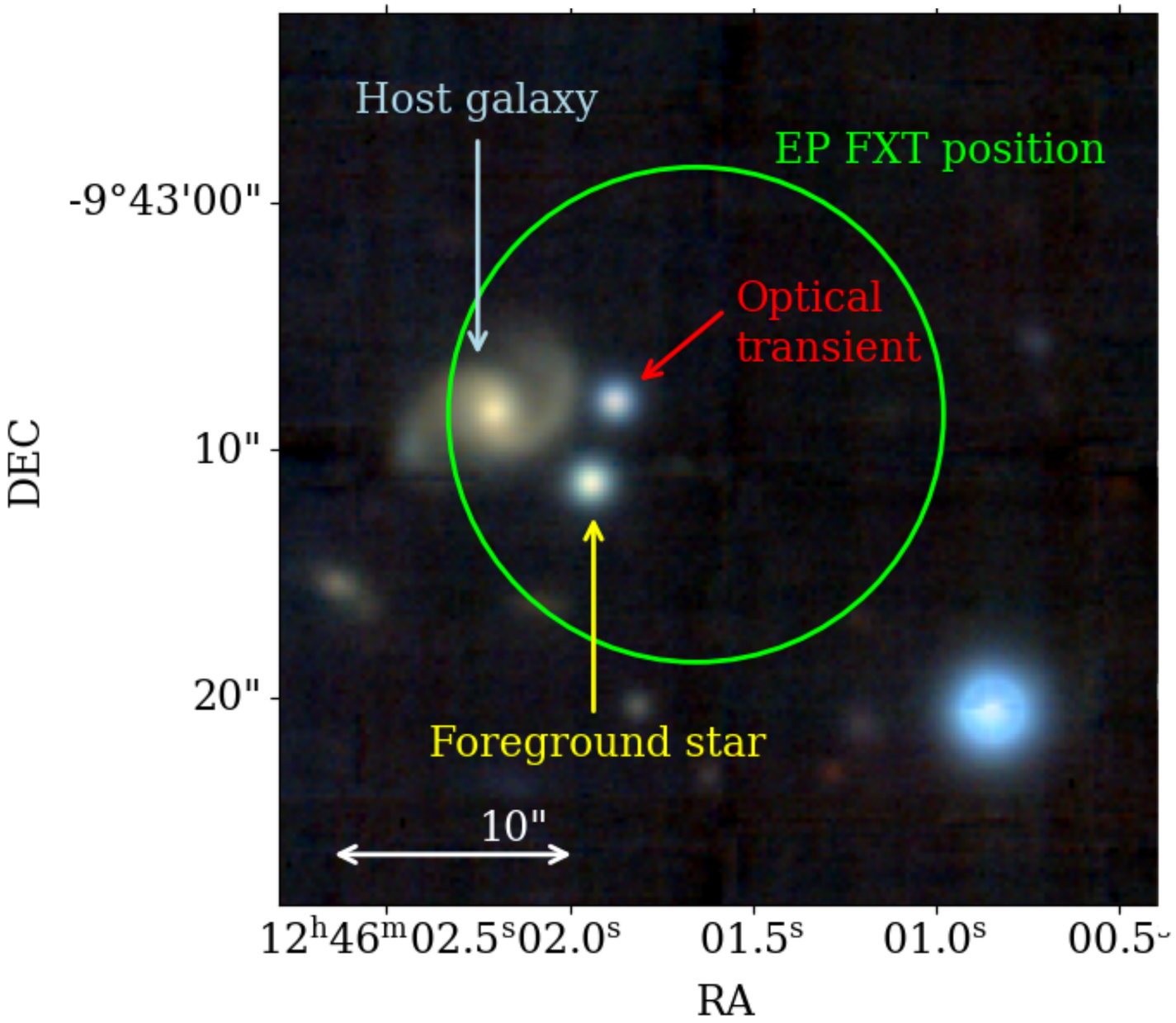
Off-axis GRBs?

Difficult: Wichern, Ravasio, PGJ et al. 2024

Otherwise related to l/ul/llGRBs?

e.g., Bauer et al. 2017

Are Einstein Probe FXTs all normal collapsars?



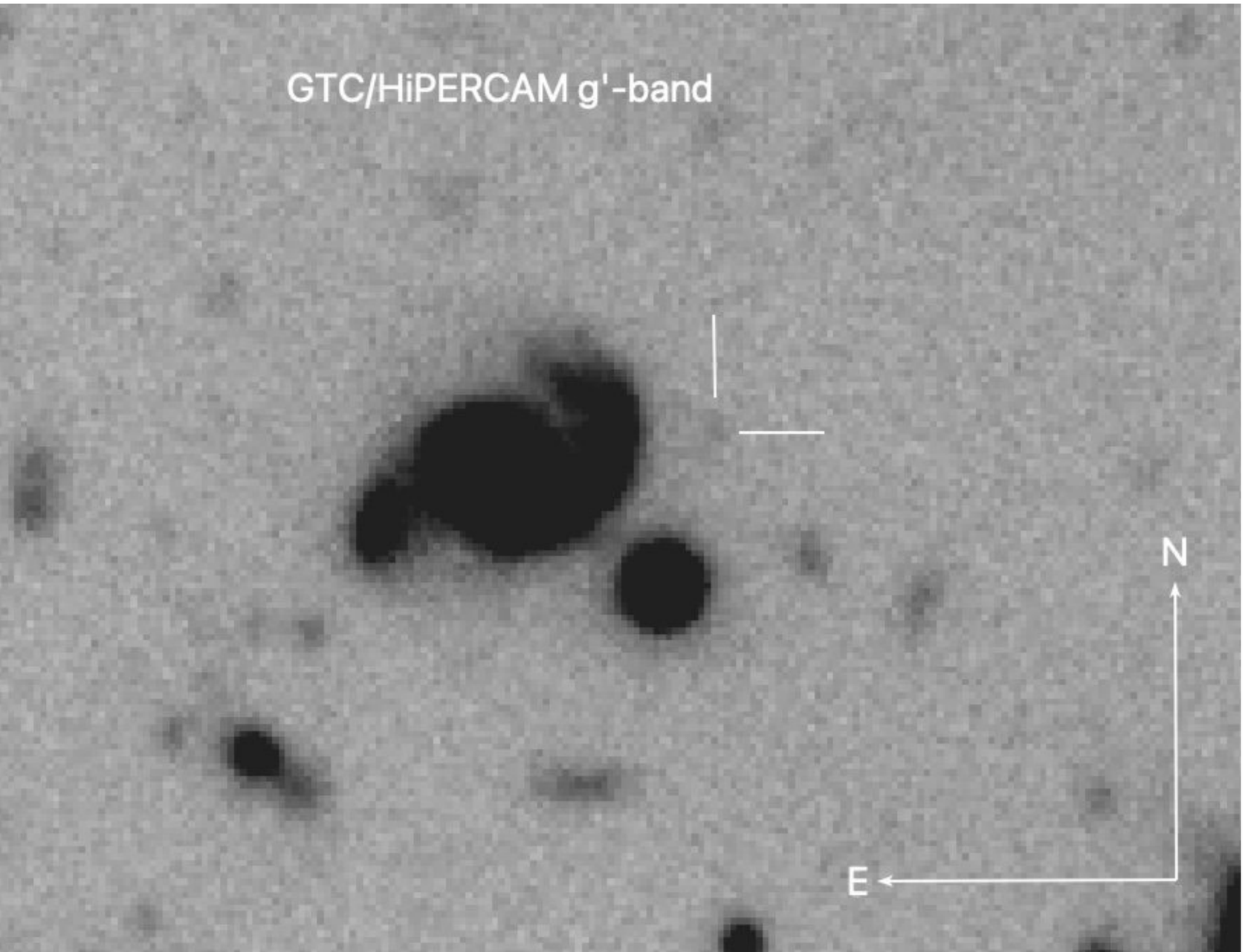
EP240414a

Redshift z=0.4

van Dalen et al. 2024; Lin et al. 2024

See talk Hui Sun later today

Are Einstein Probe FXTs all normal collapsars?



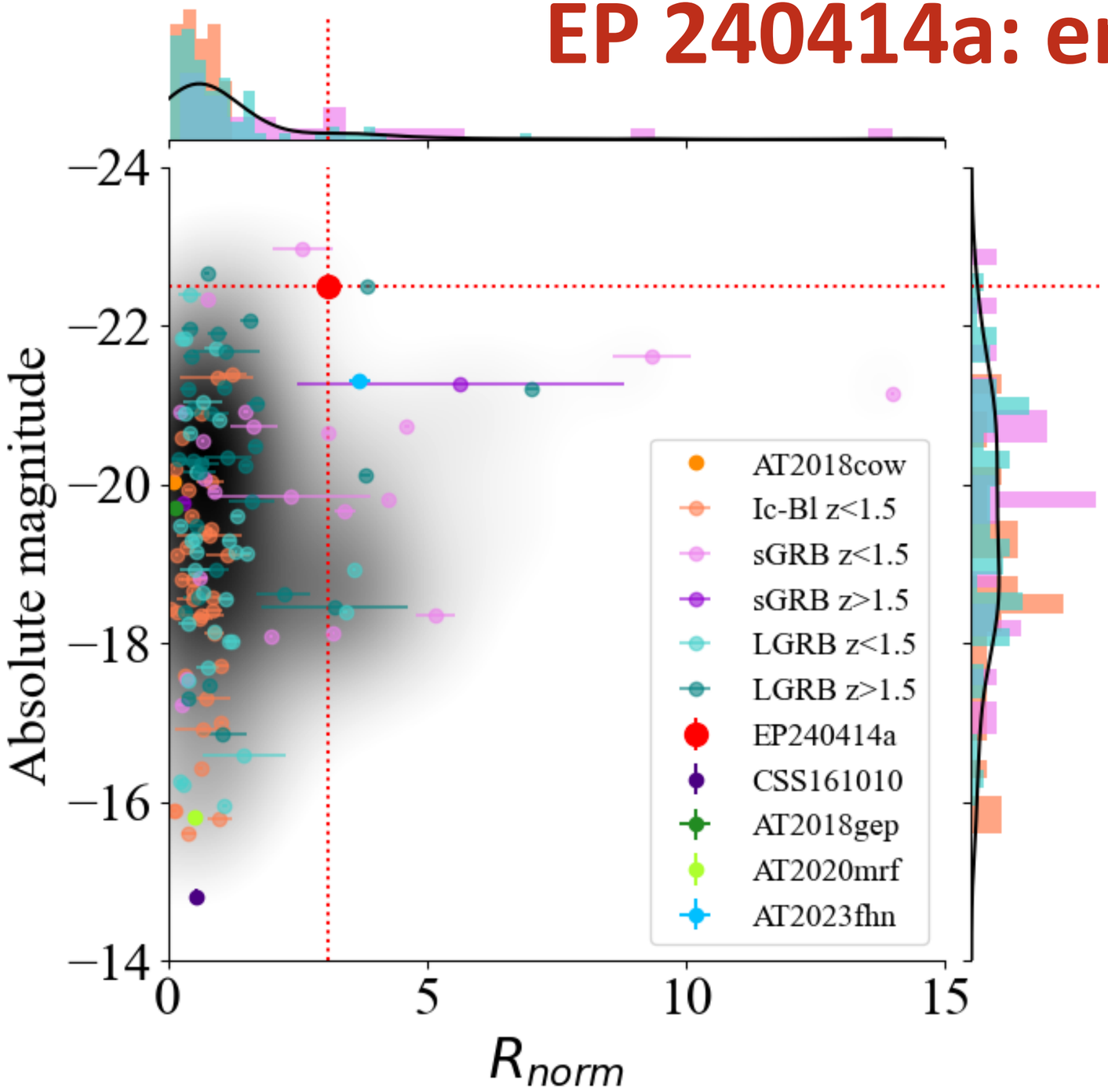
EP240414a

Redshift z=0.4

Faint dwarf host?

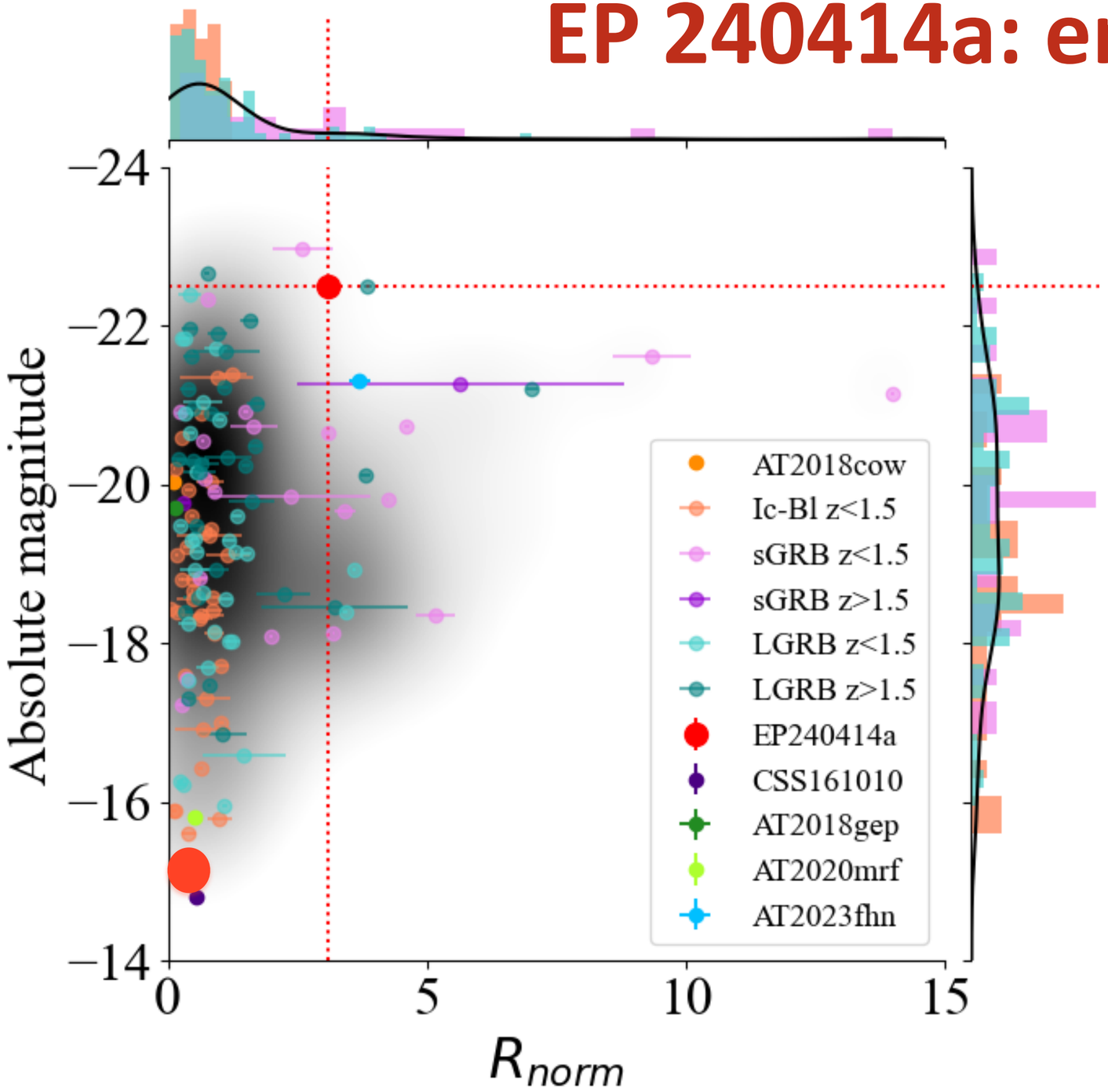
$M_{g'} \approx -15.6$

EP 240414a: environment



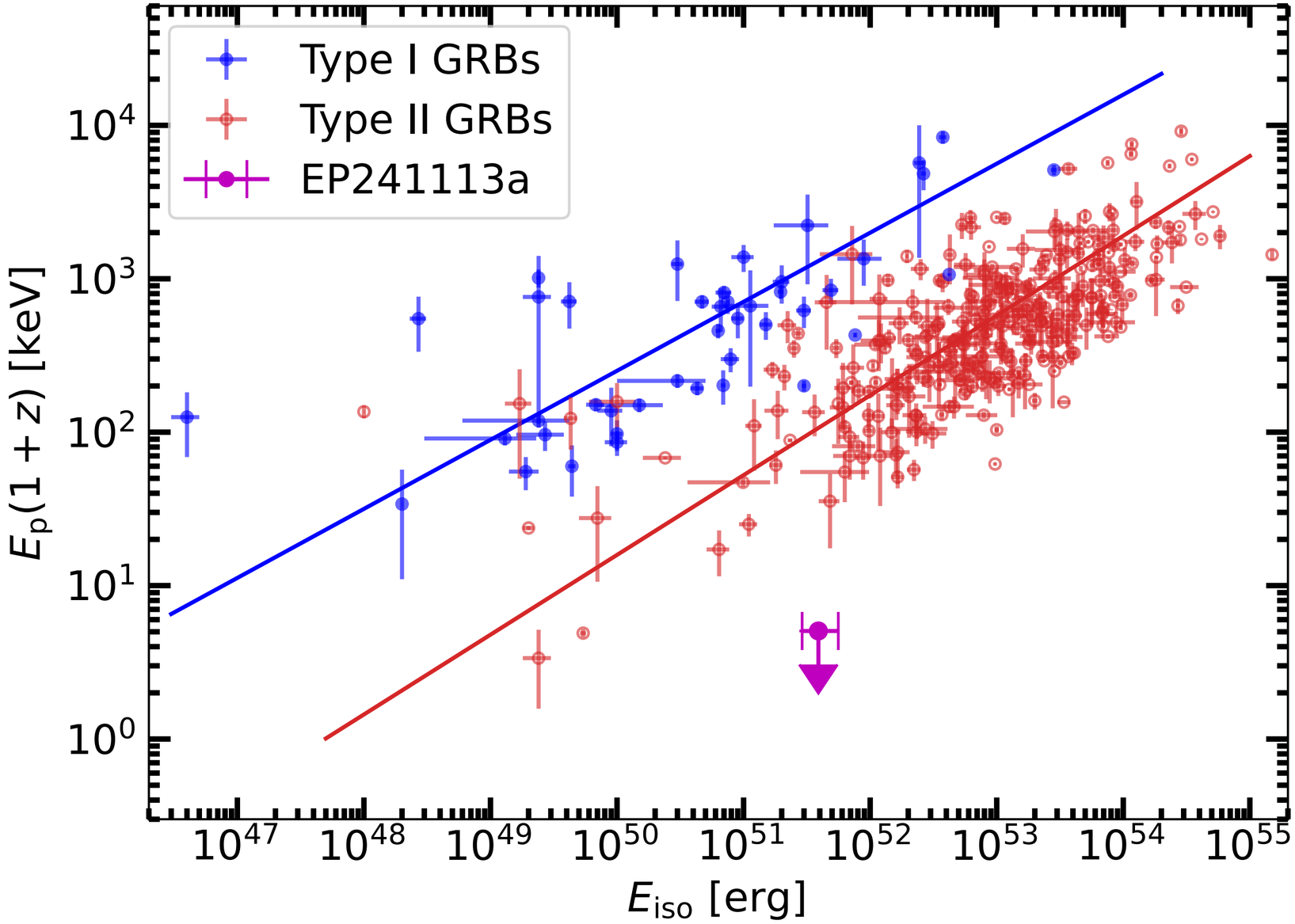
van Dalen et al. 2024
LFBOT-like host?

EP 240414a: environment



van Dalen et al. 2024
LFBOT-like host?

Einstein Probe: FXTs all normal collapsars?



Quirola-Vásquez et al. 2024;
GCN38449; z=1.53 (?)

Xiang-Yu Wang et al. in prep.

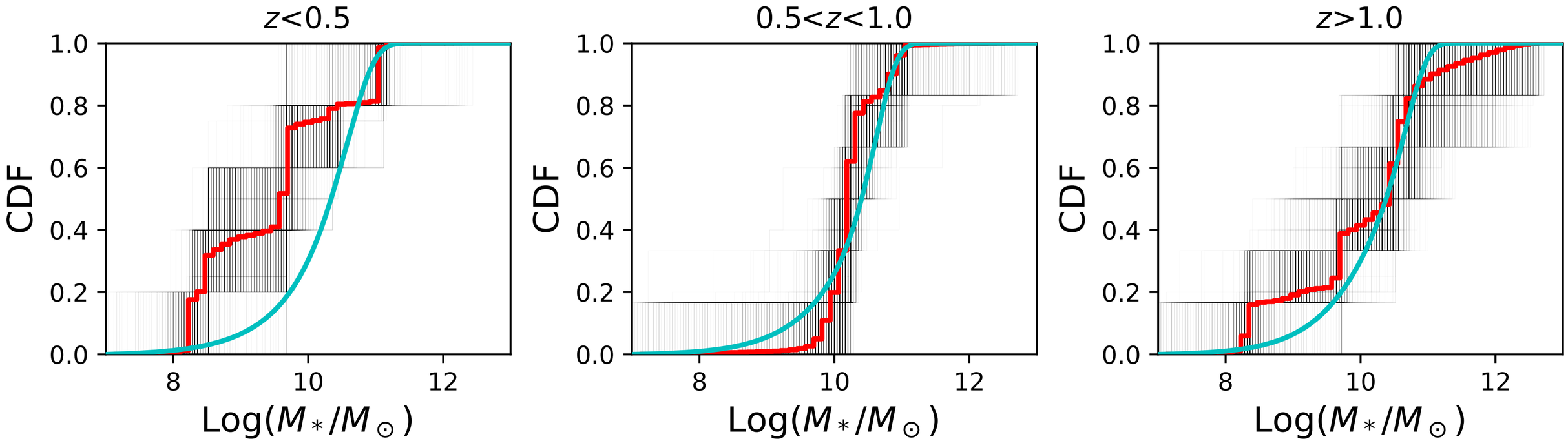
Conclusions and Outlook

- Swift's quick localisations are important for finding optical counterparts

- Einstein Probe >100 FXTs in 1 yr, many more to come, latency is decreasing

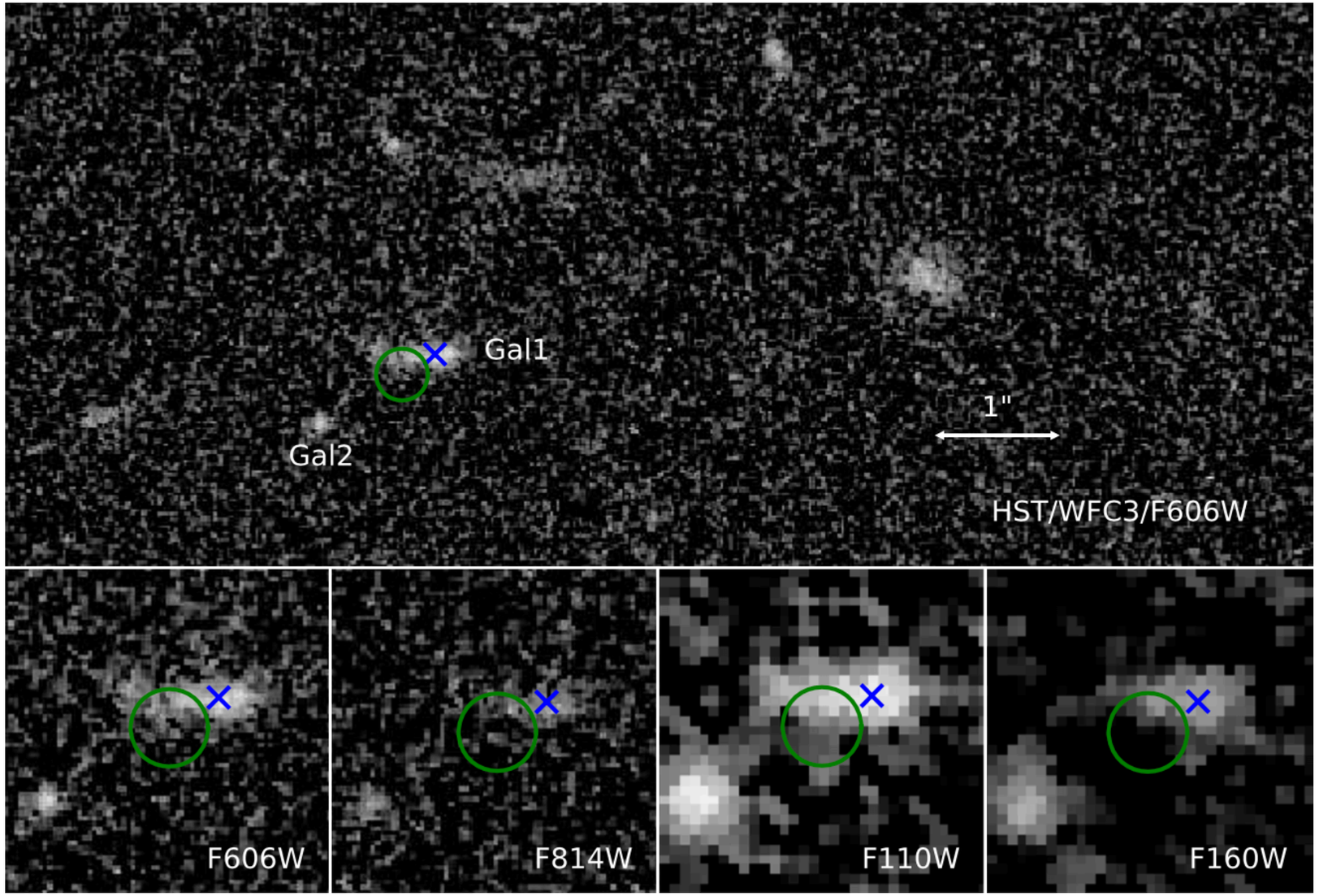
- Unclear still if all FXTs are related to collapsars or binary compact mergers or something else:
need synergy of
EP, Swift & SVOM (VT), Chandra, XMM-Newton, Fermi/GBM
and fast optical follow-up

Hosts of Chandra-discovered events



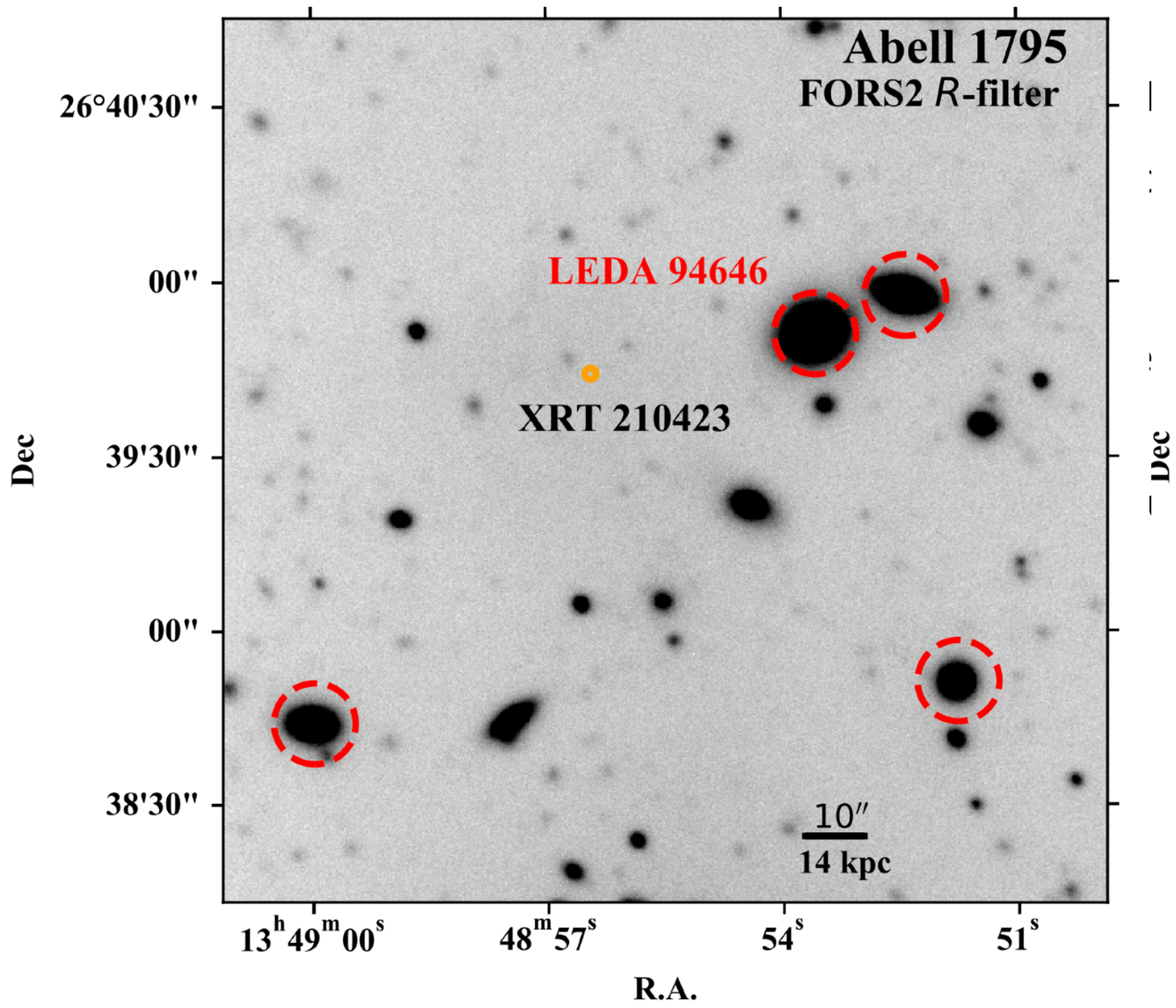
Quirola-Vásquez et al. in prep

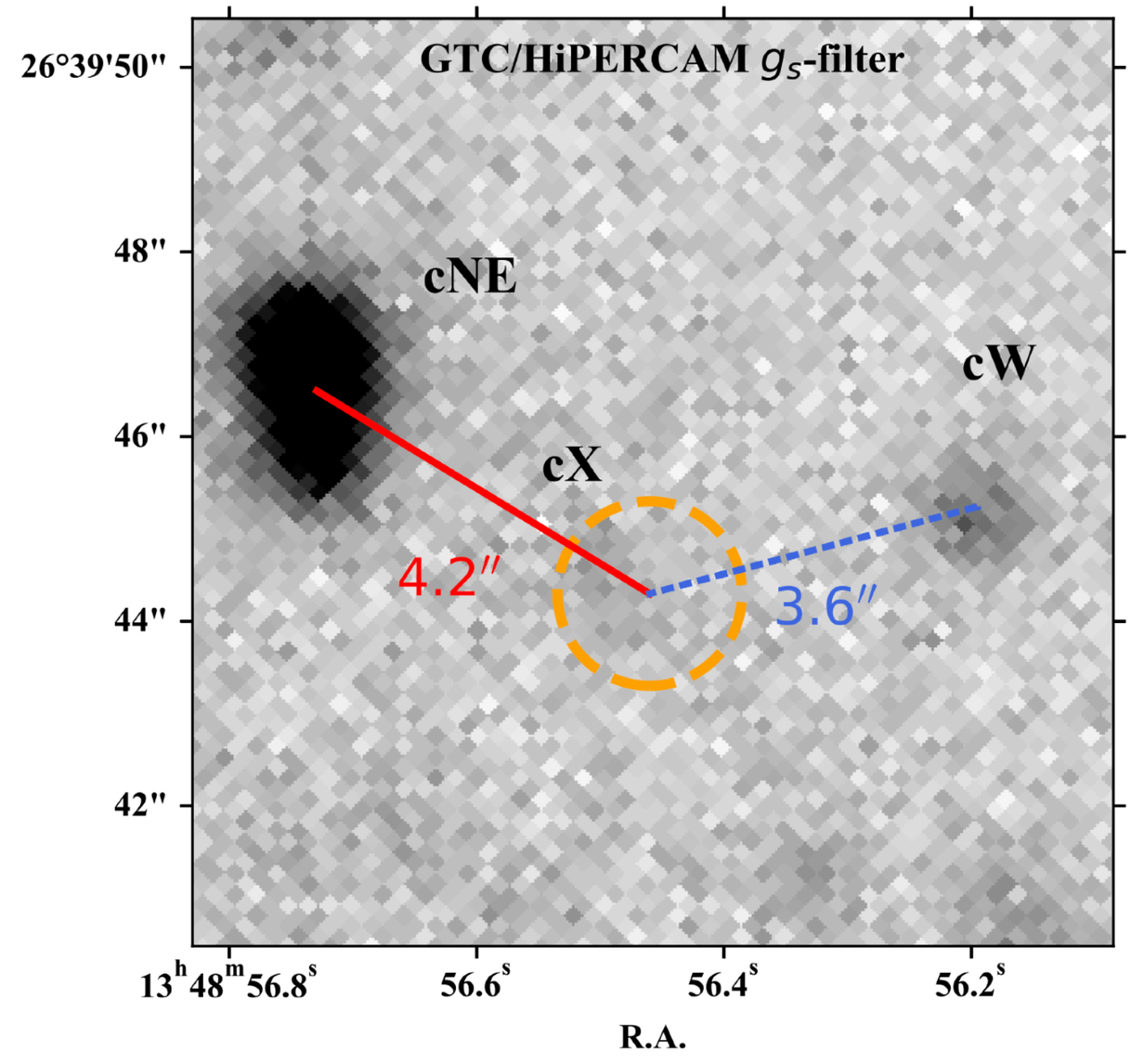
Chandra FXTs & host galaxy offsets



Lin et al. 2022

Chandra FXTs & host galaxy offsets





Eappachen et al. 2023