

# AT2023fhn (the Finch) & other animals

---

Ashley Chrimes<sup>1,2</sup>

European Space Agency Research Fellow

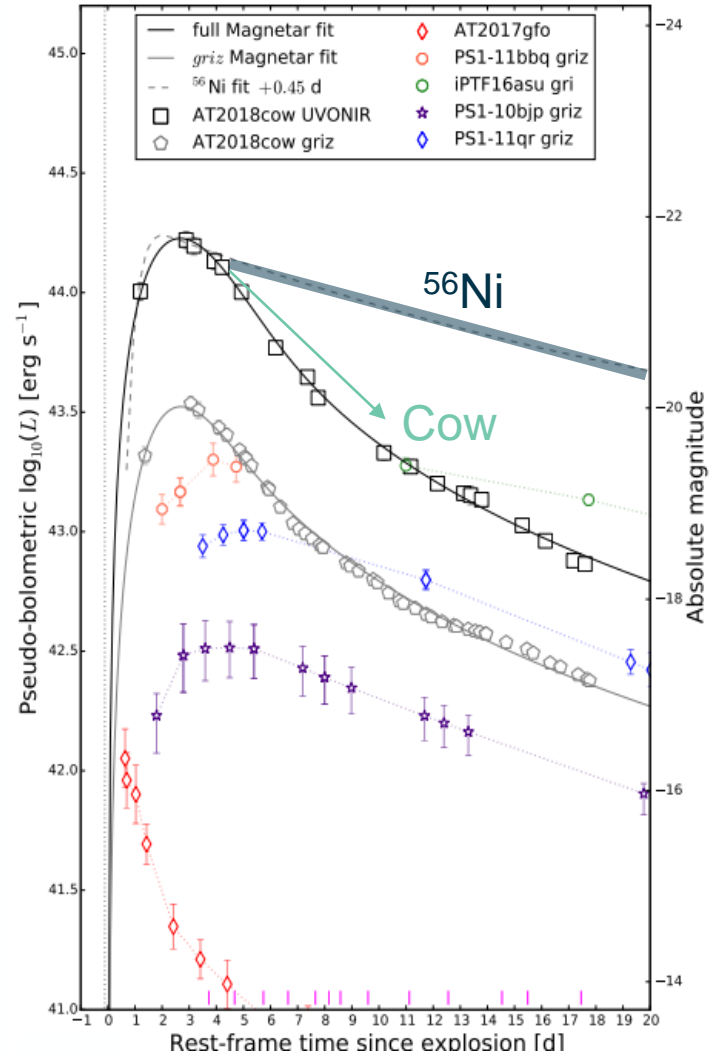
<sup>1</sup> European Space Research & Technology Centre, Noordwijk, the Netherlands

<sup>2</sup> Department of Astrophysics/IMAPP, Radboud University, Nijmegen, the Netherlands

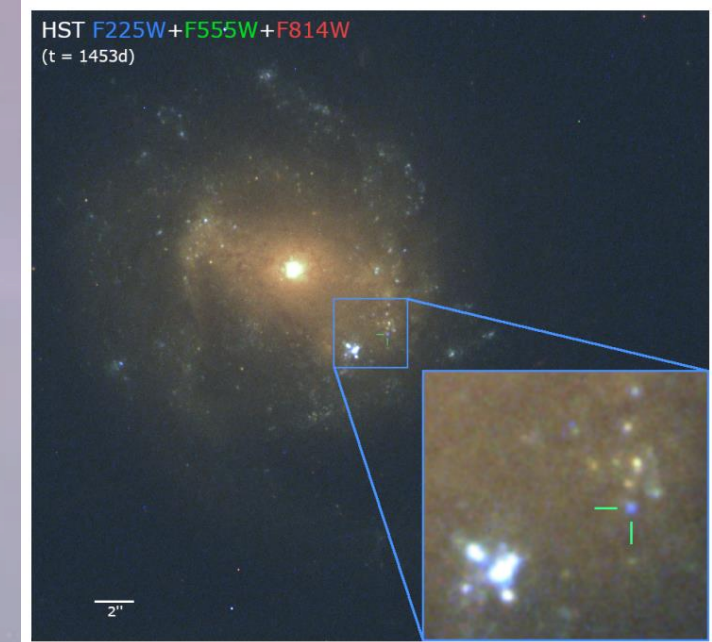
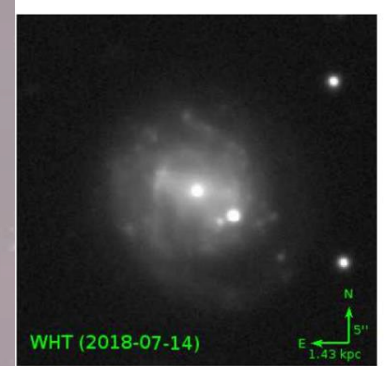
SSW16 - 23/01/2024

ESA UNCLASSIFIED – For ESA Official Use Only

# AT2018cow – a remarkable extragalactic transient



- Timescale too fast/luminosity too high for  $^{56}\text{Ni}$
- Featureless blue spectrum,  $T_{\text{BB}} \sim 30000\text{K}$
- X-ray bright, highly variable
- Radio bright (dense circumstellar medium)
- Star-forming spiral host ( $z=0.014$ )
- Highly polarized  $\rightarrow$  aspherical



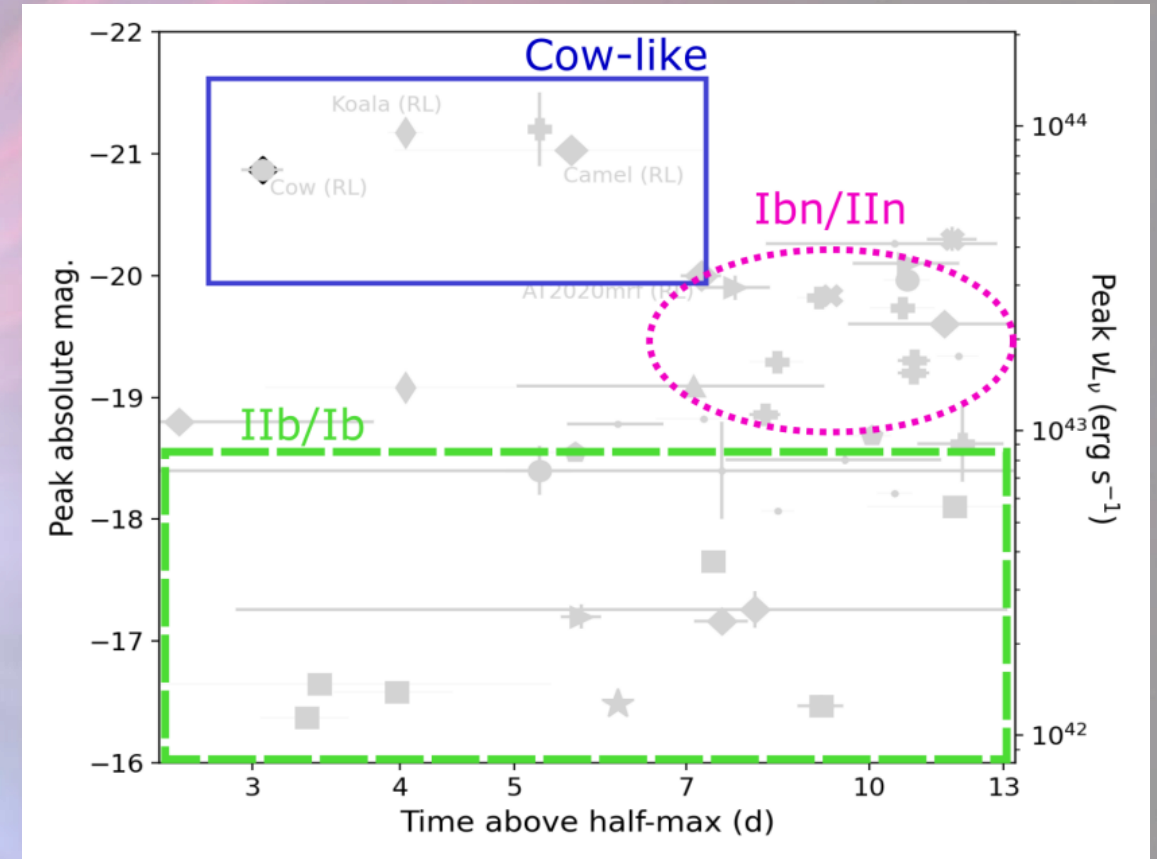
Prentice et al. 2018, Perley et al. 2019, Margutti et al. 2019, Maund et al. 2023, Chen et al. 2023



# (Luminous) Fast Blue Optical Transients

Confirmed LFBOTs (up to 2023):

Ultra-stripped, engine-powered SNe? Tidal disruption events? Other?



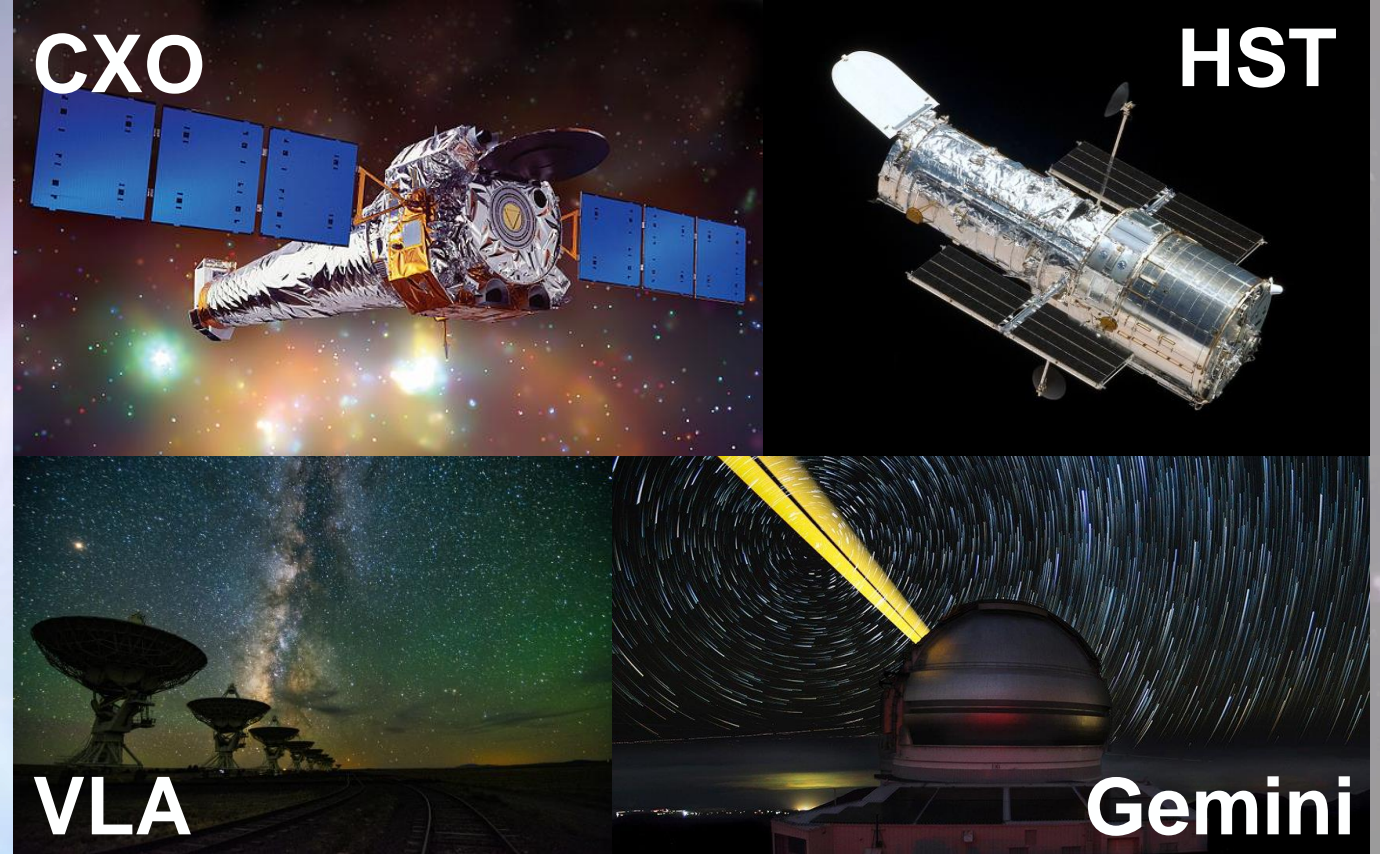
Ho et al. (2023)

[1] Prentice et al. 2018 [2] Ho et al. 2020 [3] Perley et al. 2021 [4] Matthews et al. 2023 [5] Chrimes et al. 2024 [6] Coppejans et al. 2020 [7] Yao et al. 2022

# AT2023fhn (the Finch)



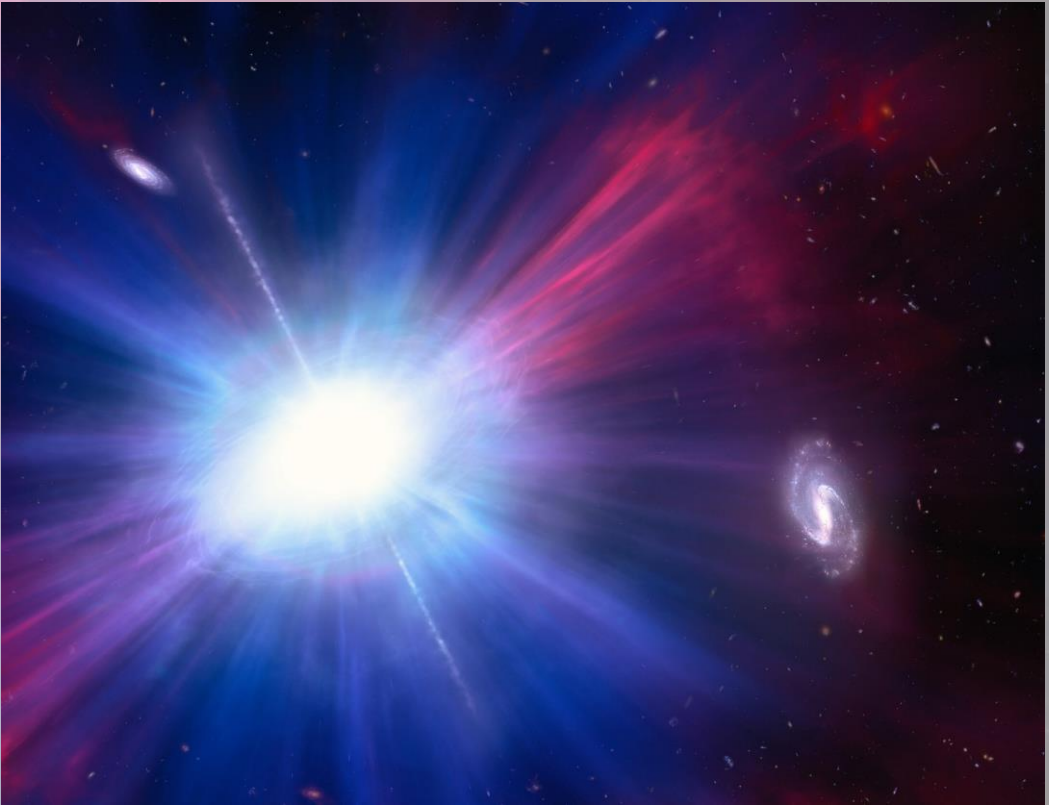
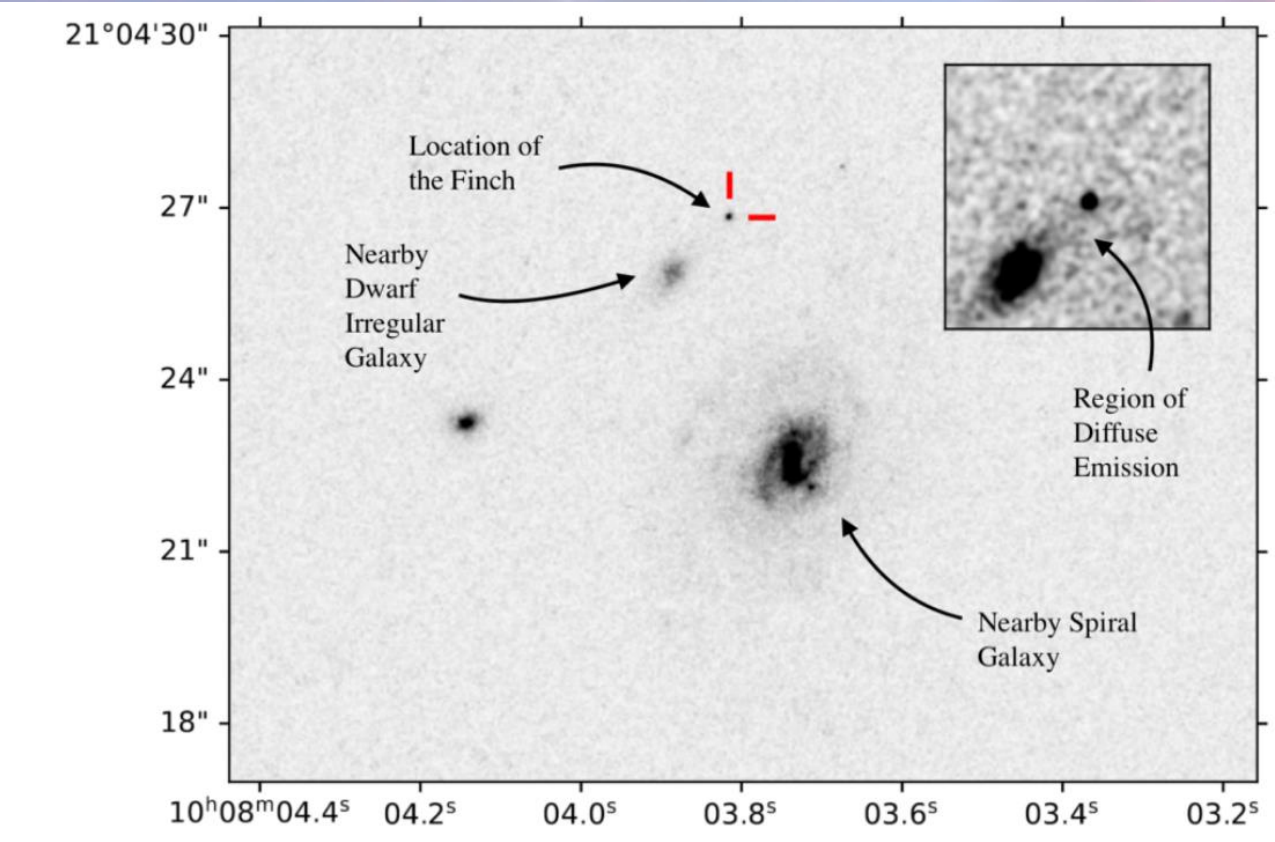
- Discovered by ZTF on 10-Apr-2023
- Featureless spectrum from VLT/FORS2  
→ trigger joint programme





# An unexpected location

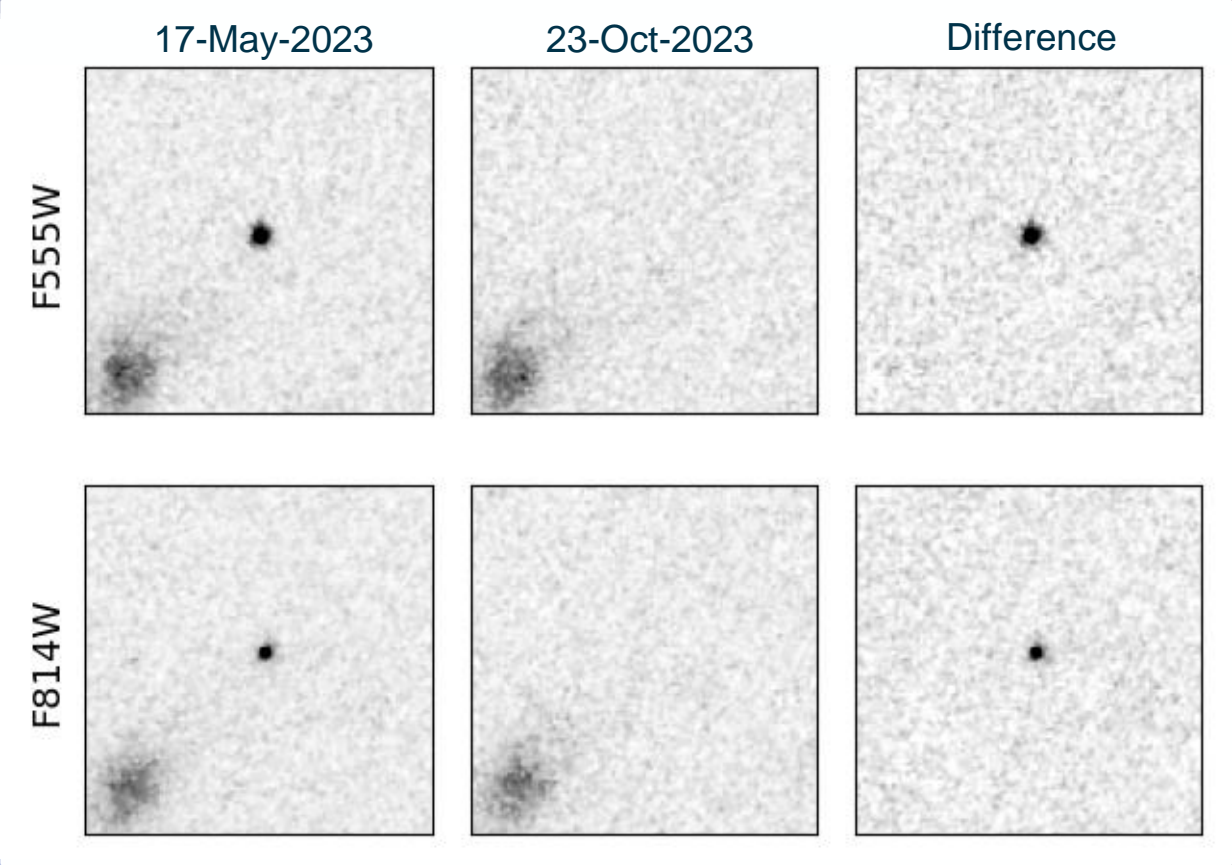
Chrimes et al. (2024) | MNRASL 527 L47 | arxiv:2307.01771



NASA, ESA, NSF's NOIRLab, M. Garlick, M. Zamani

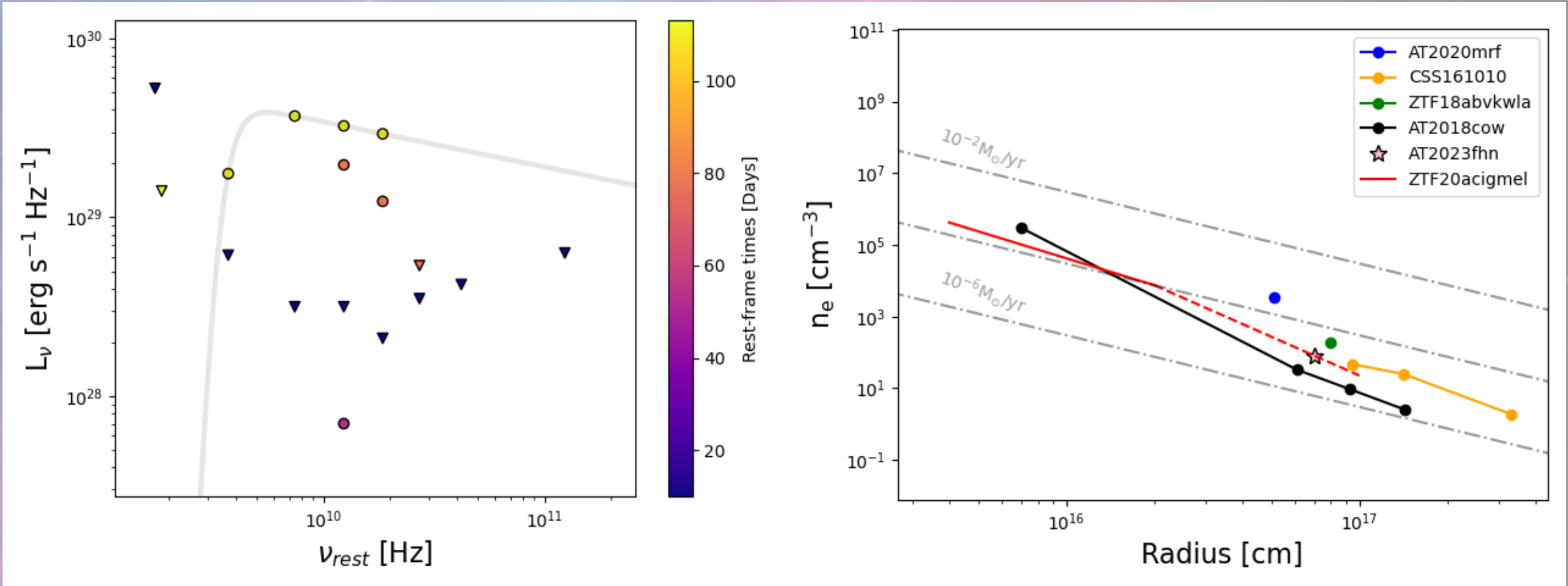
“Luminous, Fast and Blue: Do the Finch and the Cow Share a Common Ancestor?”  
- *astrobites* / Sonja Panjkov & Keighley Rockcliffe

No significant underlying population. Limits consistent with a Cow-like evolution.

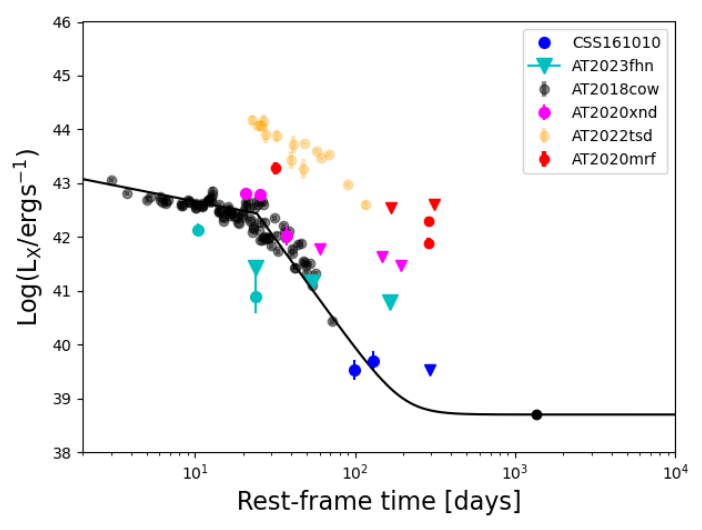


Synchrotron  $\rightarrow R_{\text{emit}} = 7 \times 10^{16} \text{cm}$ ,  $n_e = 80 \text{ cm}^{-3}$ ,  $v = 0.24c$

**Density high despite isolated location:** associated with progenitor (e.g. dense wind), not the environment

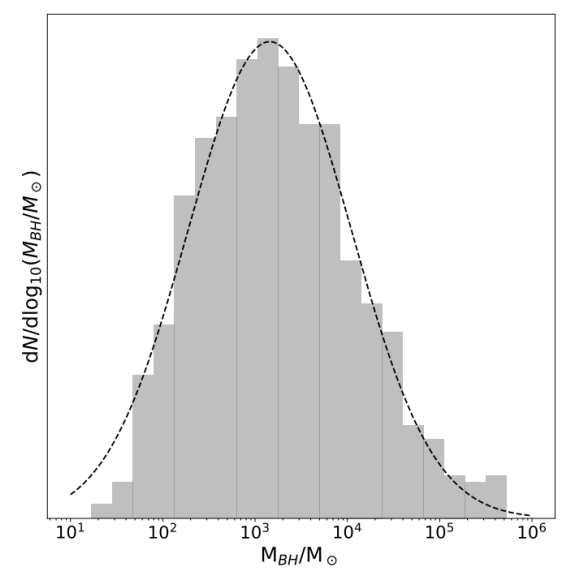


# Recent LFBOT developments



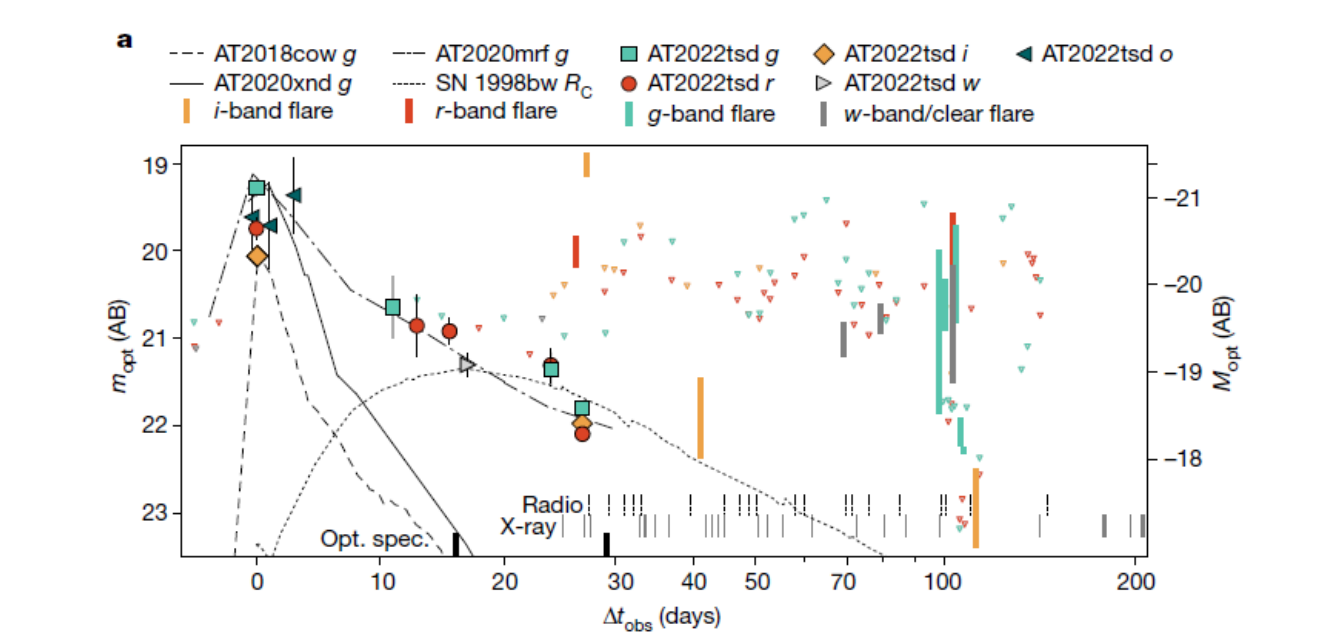
AT2018cow  
Late-time X-ray plateau  
(Migliori et al. 2023)

$M_{\text{BH}} \sim 10\text{-}100\ M_{\odot}$



AT2018cow  
Late-time UV plateau  
(Inkenhaag et al. 2023)

$M_{\text{BH}} \sim 1000\ M_{\odot}$



AT2022tsd – minute long optical flares months afterwards,  $L \sim L_{\text{SN}}$ !  
Variable accretion onto a BH?  
(Ho et al. 2023)



# Summary & next steps

- LFBOTs: **Unique extragalactic transients**, distinct from other classes
- **BH accretion power** with a **dense circumstellar medium** produced by pre-explosion outflows from the progenitor system
- Need to:
  - **build environment statistics** (kicked from birth sites?)
  - **understand variety within LFBOTs** (caused by viewing angle?)
  - **study rare, nearby events in detail** (only AT2018cow so far)

ESA missions can contribute! (HST, JWST, INTEGRAL, XMM-Newton, EP, Euclid...)

Ashley.chrimes@esa.int | ashtronomy.com

