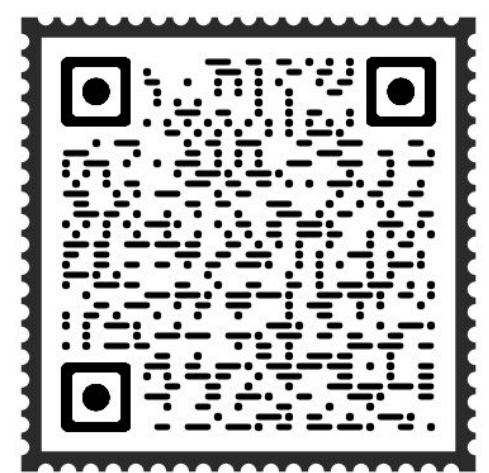


AT2025ulz and S250818k: Zooming in with HST

Paper Link


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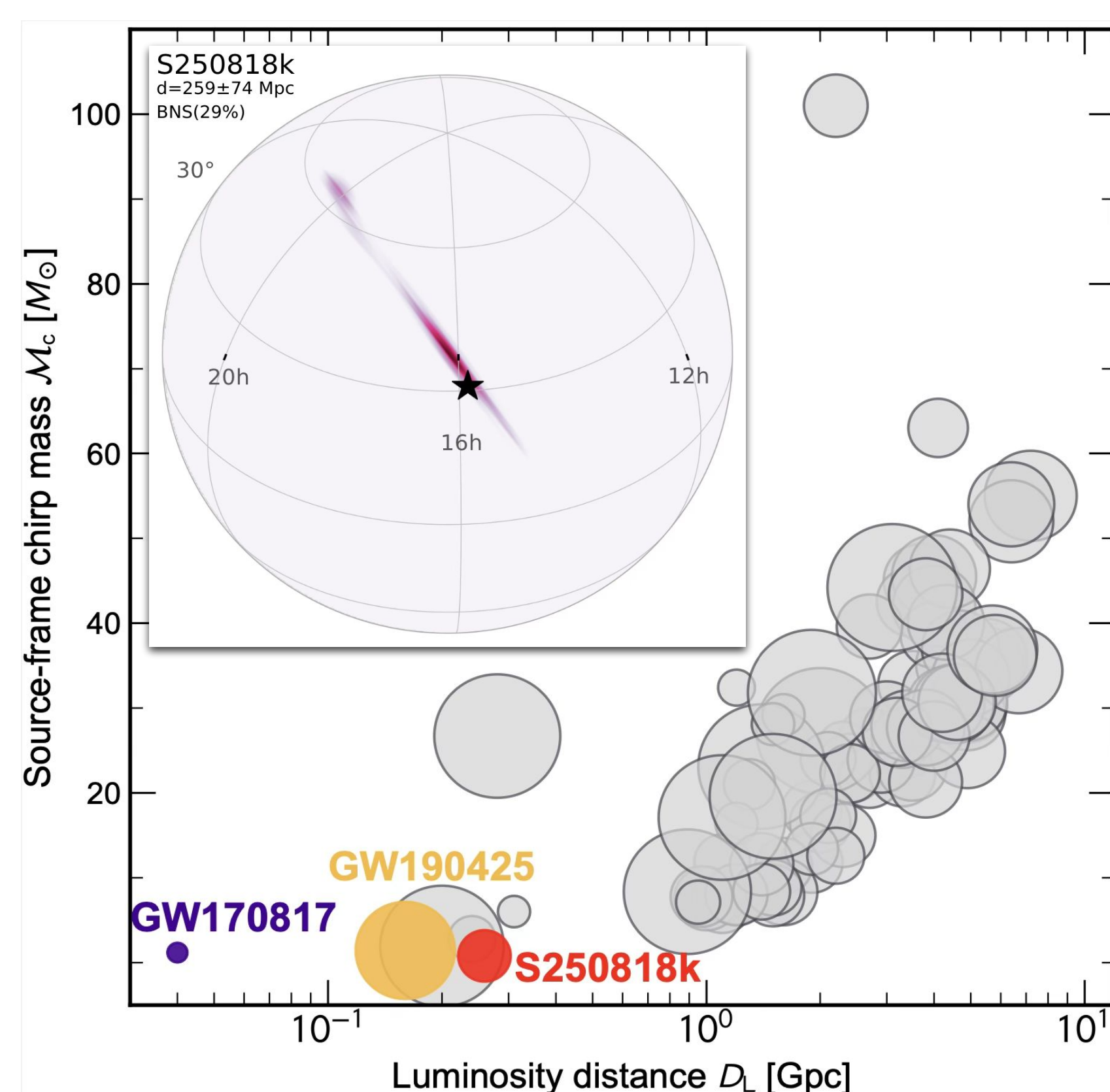
Personal Website



0. INTRODUCTION

Compact binary mergers produce gravitational waves (**GWs**) and electromagnetic emission, including kilonovae (**KNe**) powered by r-process nucleosynthesis.

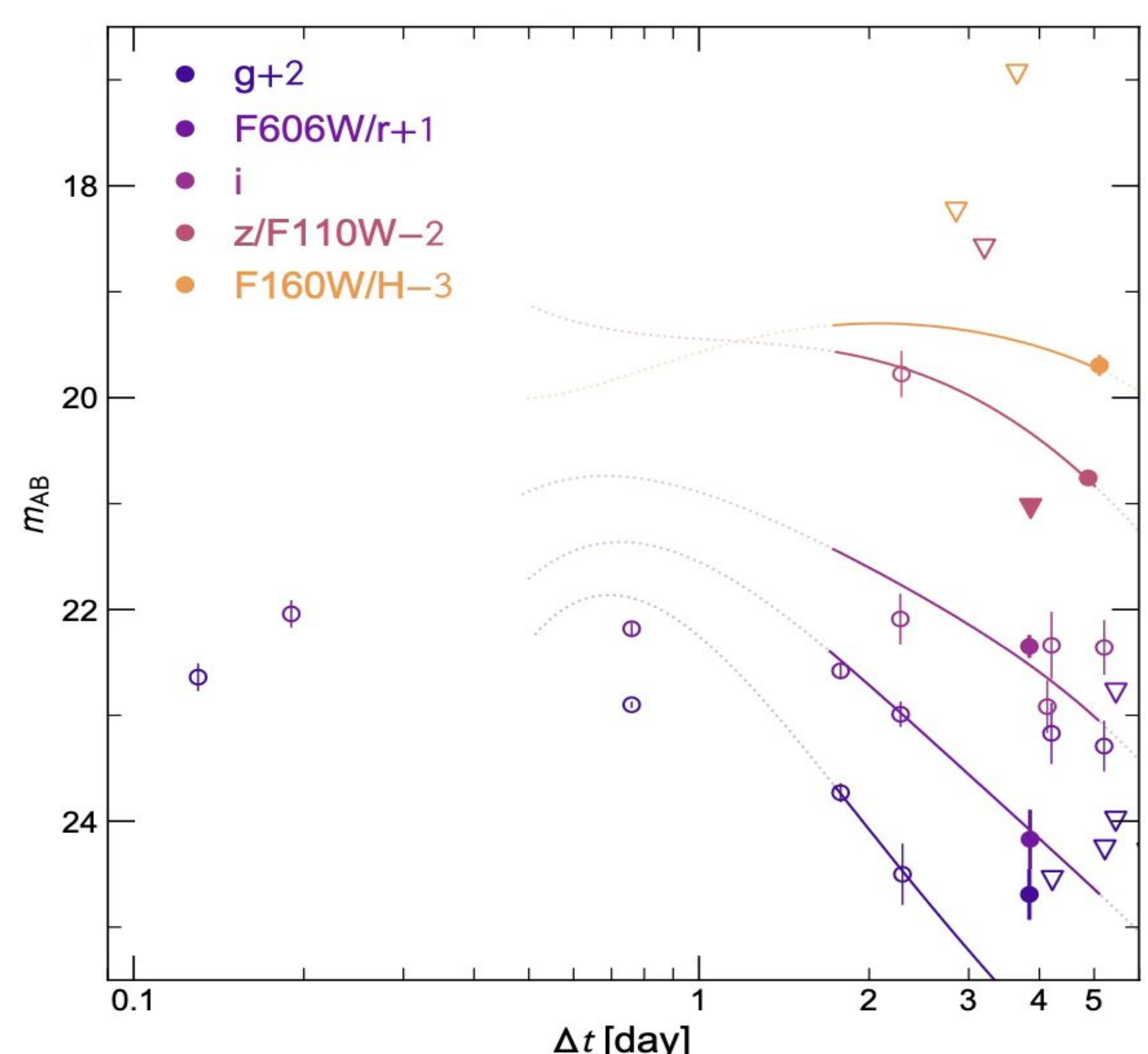
1. HUNTING FOR KILONOVAE



GW event **S250818k**: 29% BNS probability

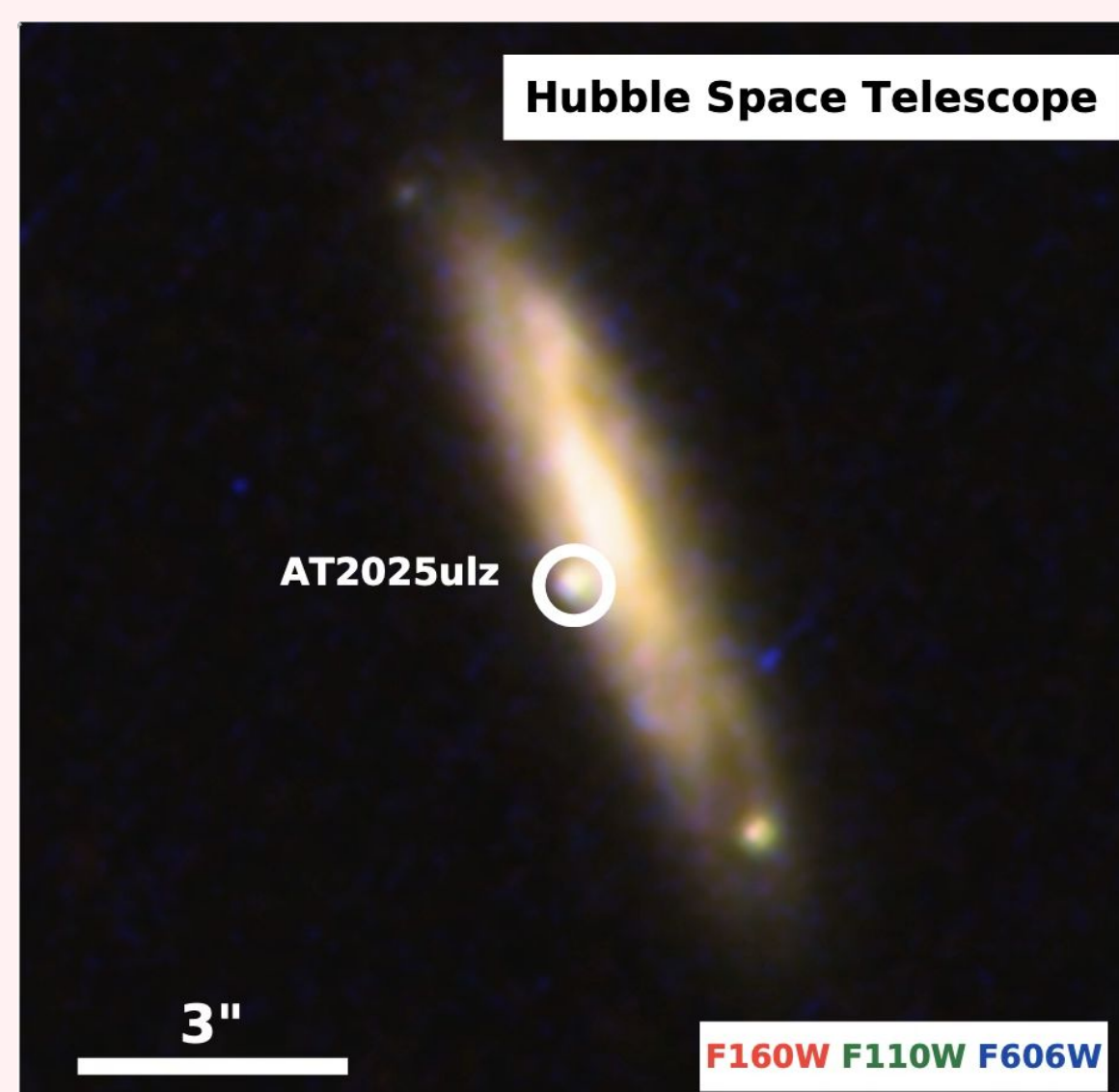
AT2025ulz: a potential counterpart found within the localization region, associated with a nearby galaxy

2. "KILONOVA-LIKE" PHASE (< 4 days)



Rapid decline in flux and red color evolution

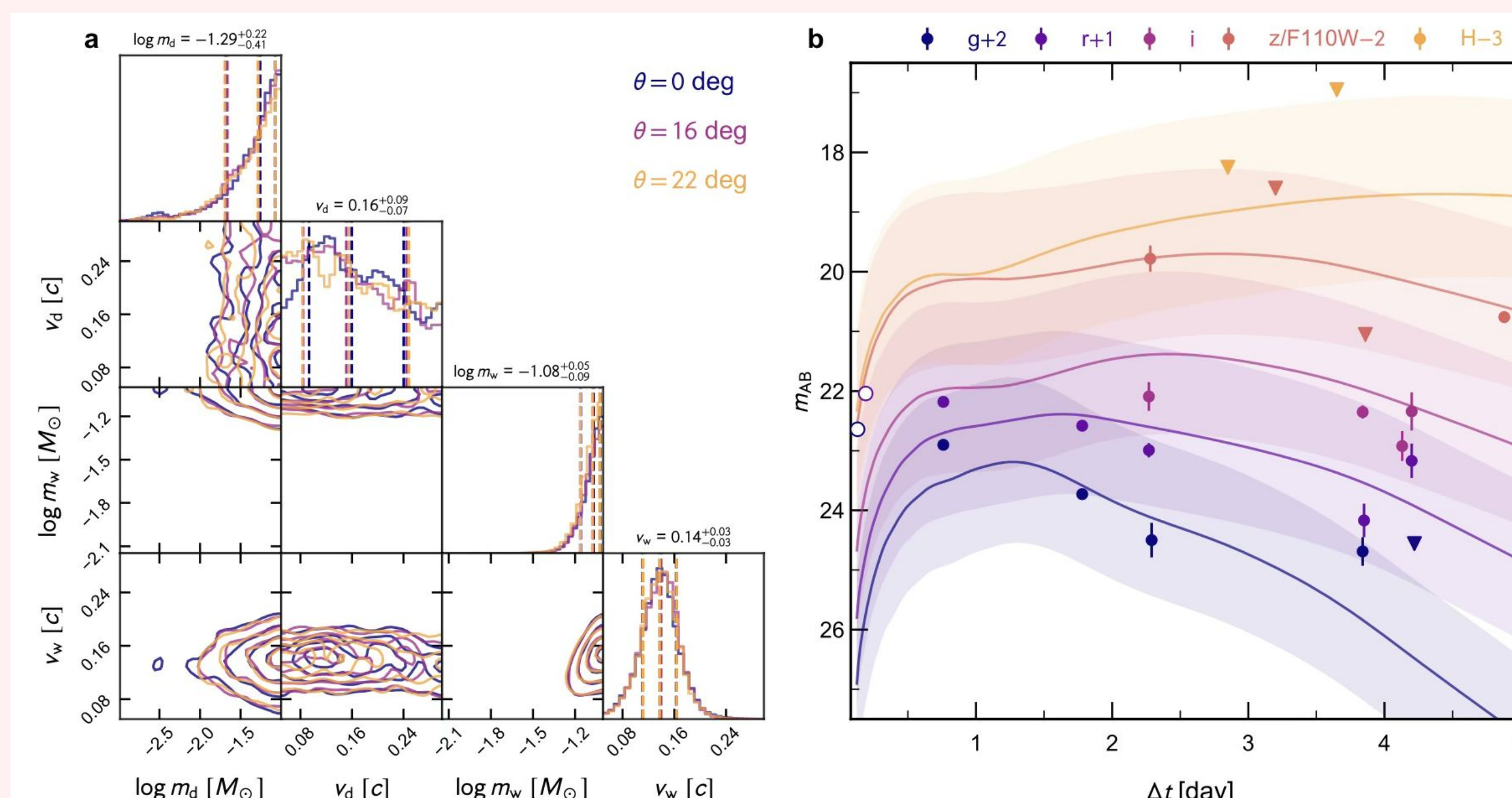
3. HST FOLLOW-UP OBSERVATIONS



Triggered HST at 4.8 days

1. **Blue Color**: F336W-F160W ≈ 1.4 mag (too blue for a KN)
2. **Edge-on spiral galaxy**: more contaminants from early-type galaxy with on-going star-formation

4. RULING OUT THE KILONOVA HYPOTHESIS



Early "rapid fade" = **shock cooling** of SN envelope

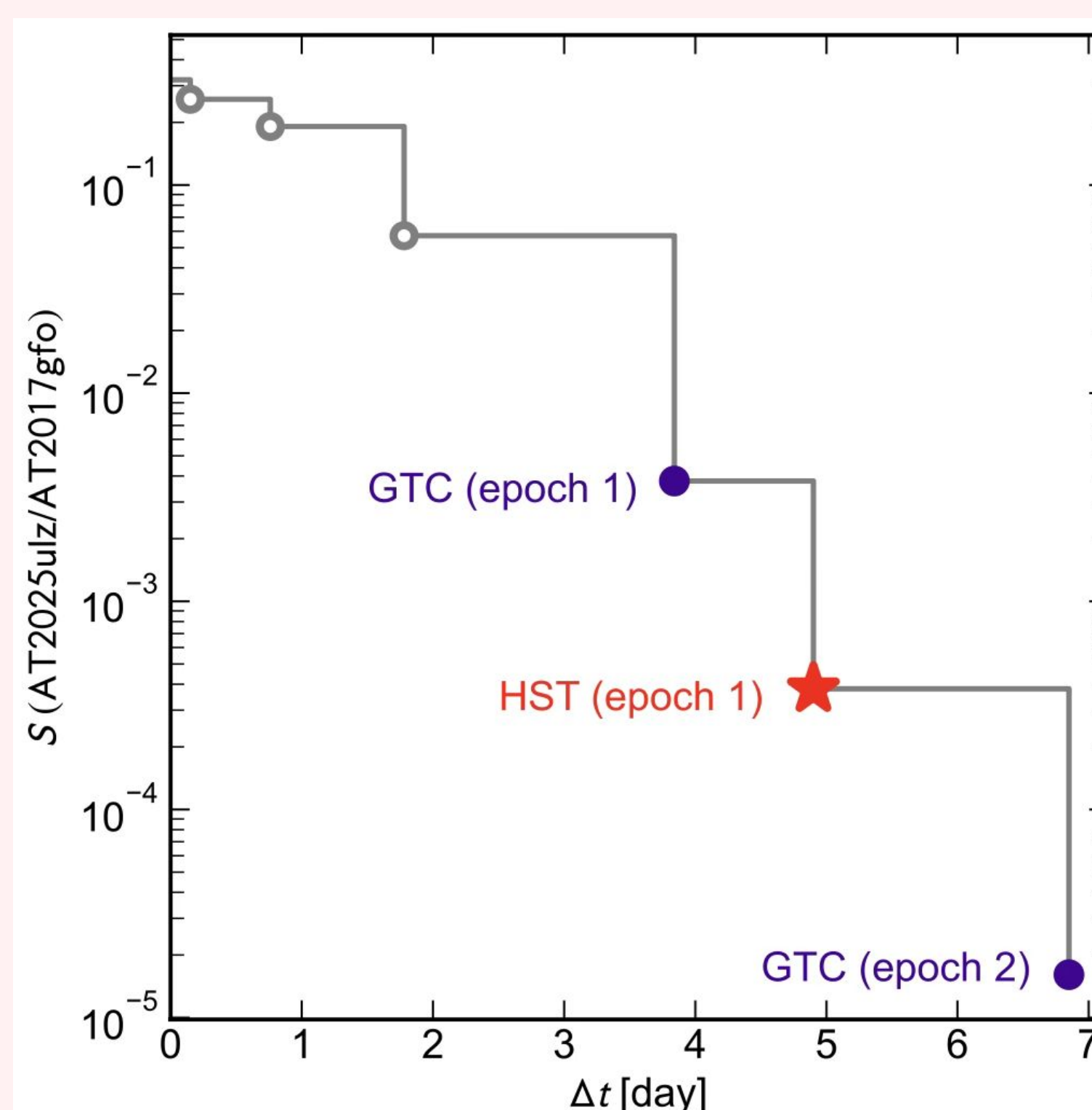
Later "rise" = main SN bump

$M_{ej} \approx 0.13 M_{\odot}$
 $\rightarrow$ inconsistent with a BNS origin for S250818k (chirp mass ~ 0.1 - $0.87 M_{\odot}$), which predicts $M_{ej} < 0.01 M_{\odot}$

GTC spectroscopy revealed **H α & H β P-Cygni features**

FINAL VERDICT
TYPE II
SUPERNOVA
 Unrelated to GW S250818k

5. IMPLICATIONS



A robust **decision tree** is crucial to rule out AT2025ulz-like events as KNe/GW counterparts. Several criteria must be considered to **identify a KN** among a myriad of other transients:

- P_{NS} GW merger contains at least a NS
- S_{3D} sky position consistent with the GW signal
- S_{age} young age estimated from historical data;
- S_{KN} luminosity and red color compatible with a KN;
- p_{galaxy} host galaxy and the location of the transient within the host