

# GW Multi-messenger science

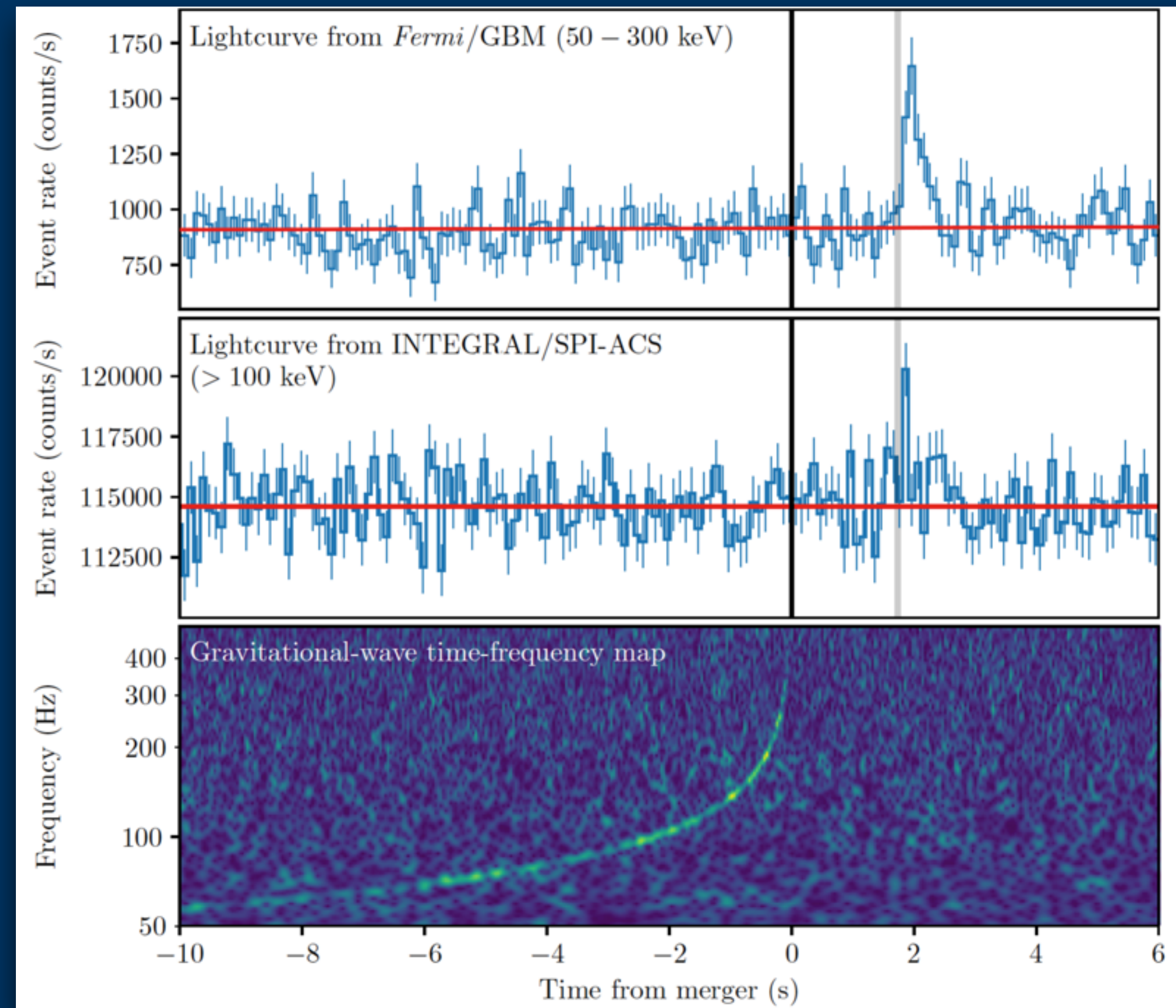
A science case for BlueMUSE

S.D. Vergani - April 24 2024



# GW170817- GRB170817

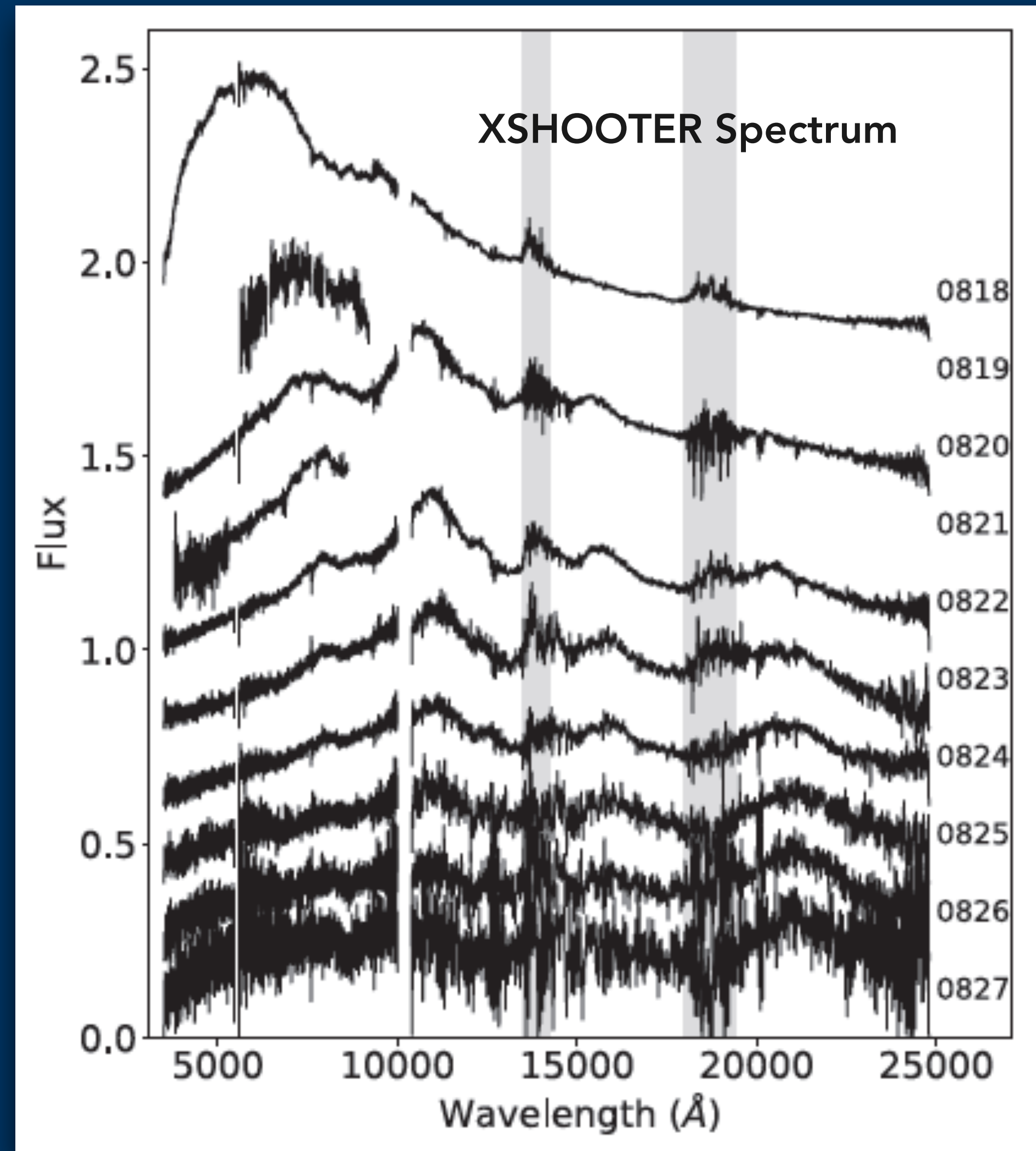
Abbott et al. 2017



Short GRB

Merger of NS binary system

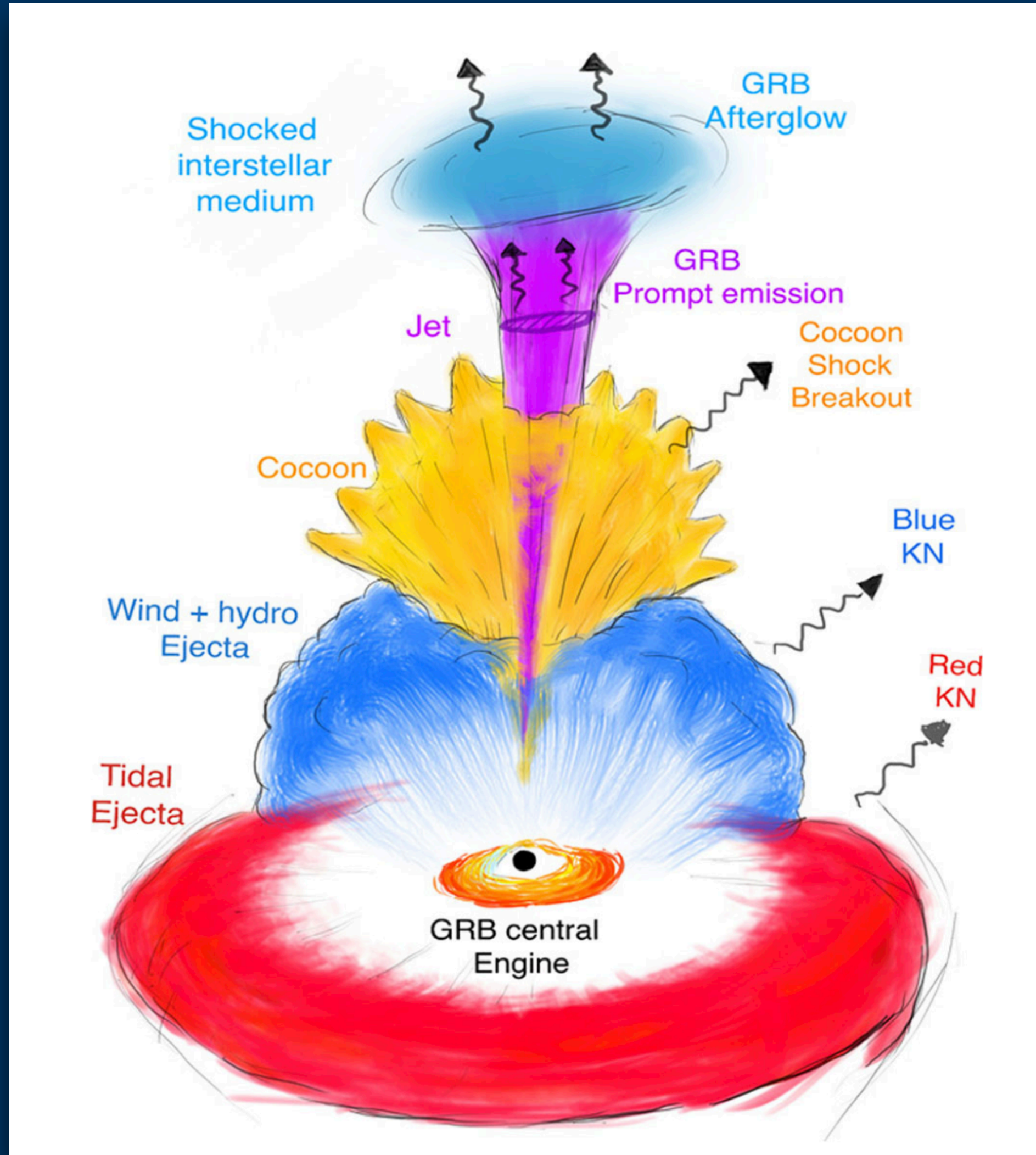
# GW170817 - AT2017gfo



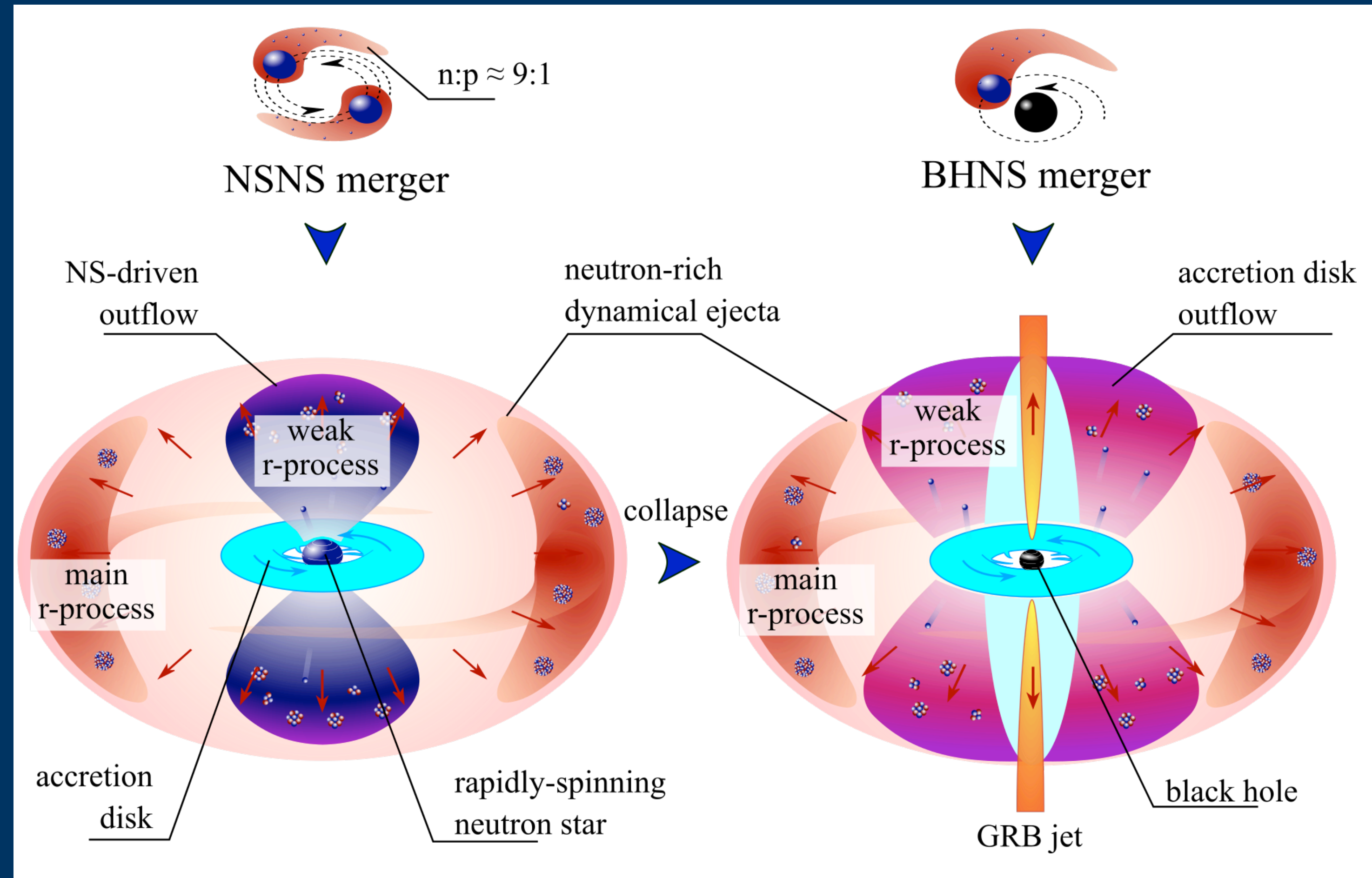
Pian et al. 2017, Nature



# Kilonova



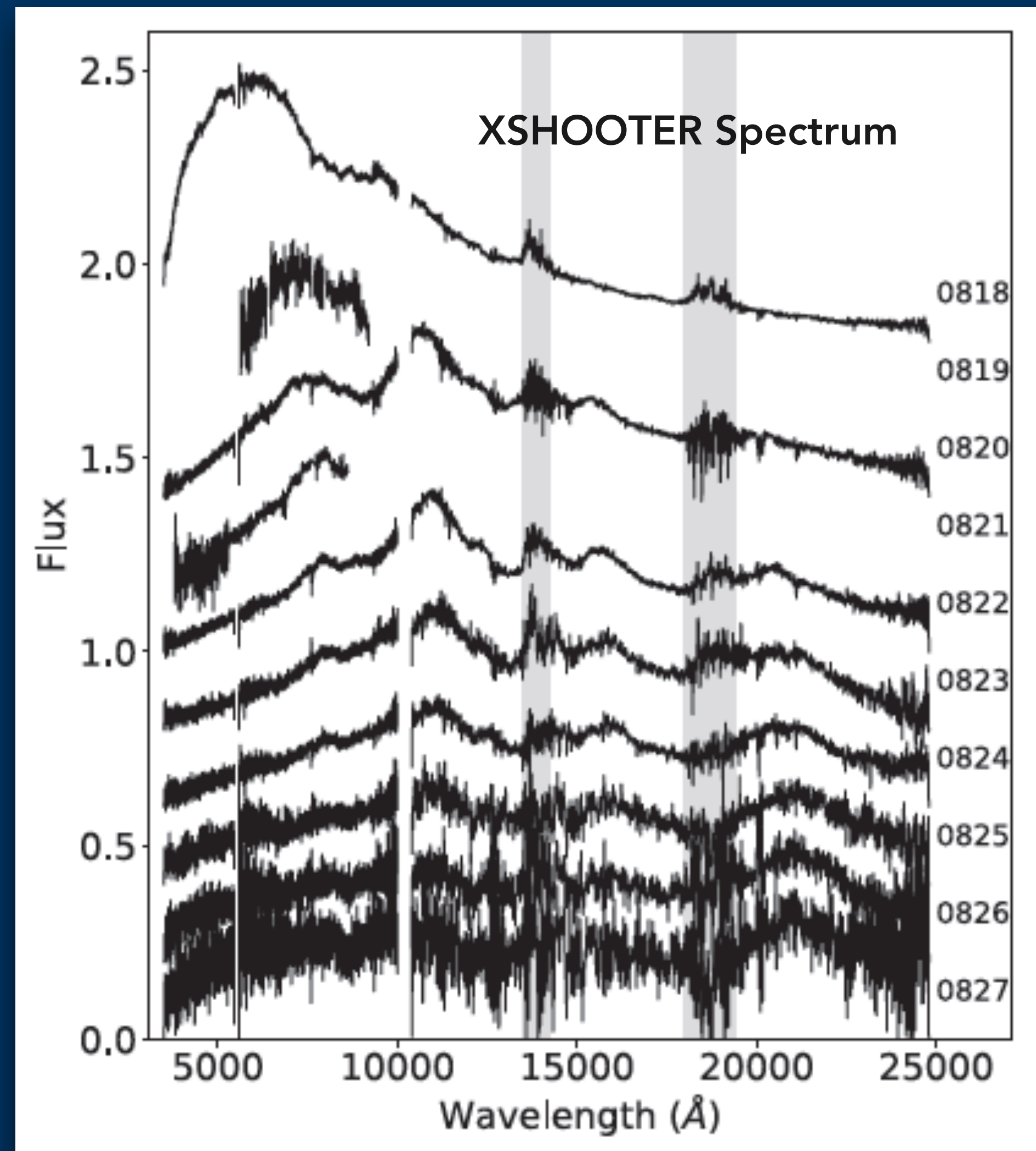
Ascenzi et al. 2021



Credits @ Mumpower 2019



# GW170817 - AT2017gfo



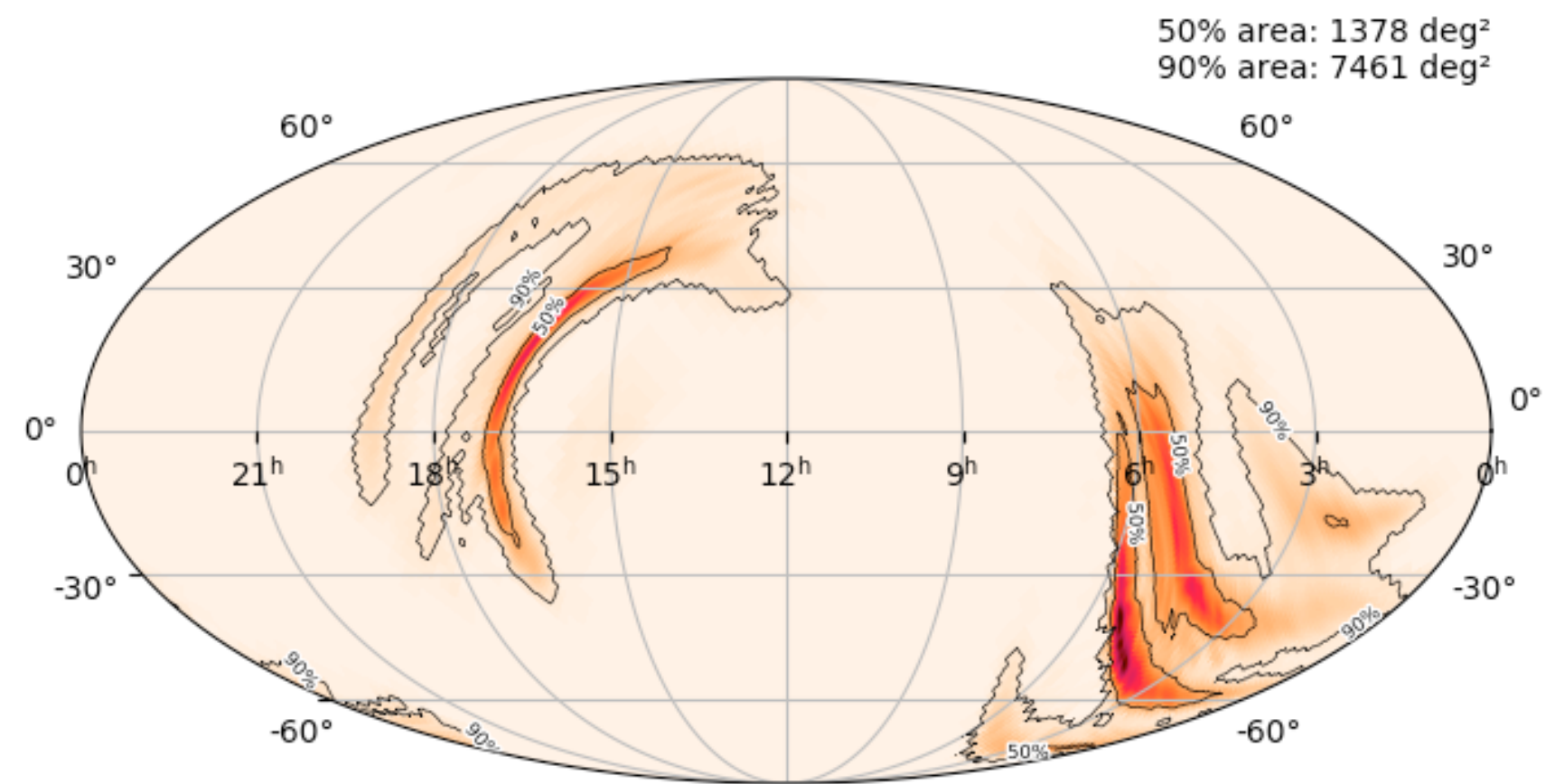
Pian et al. 2017, Nature



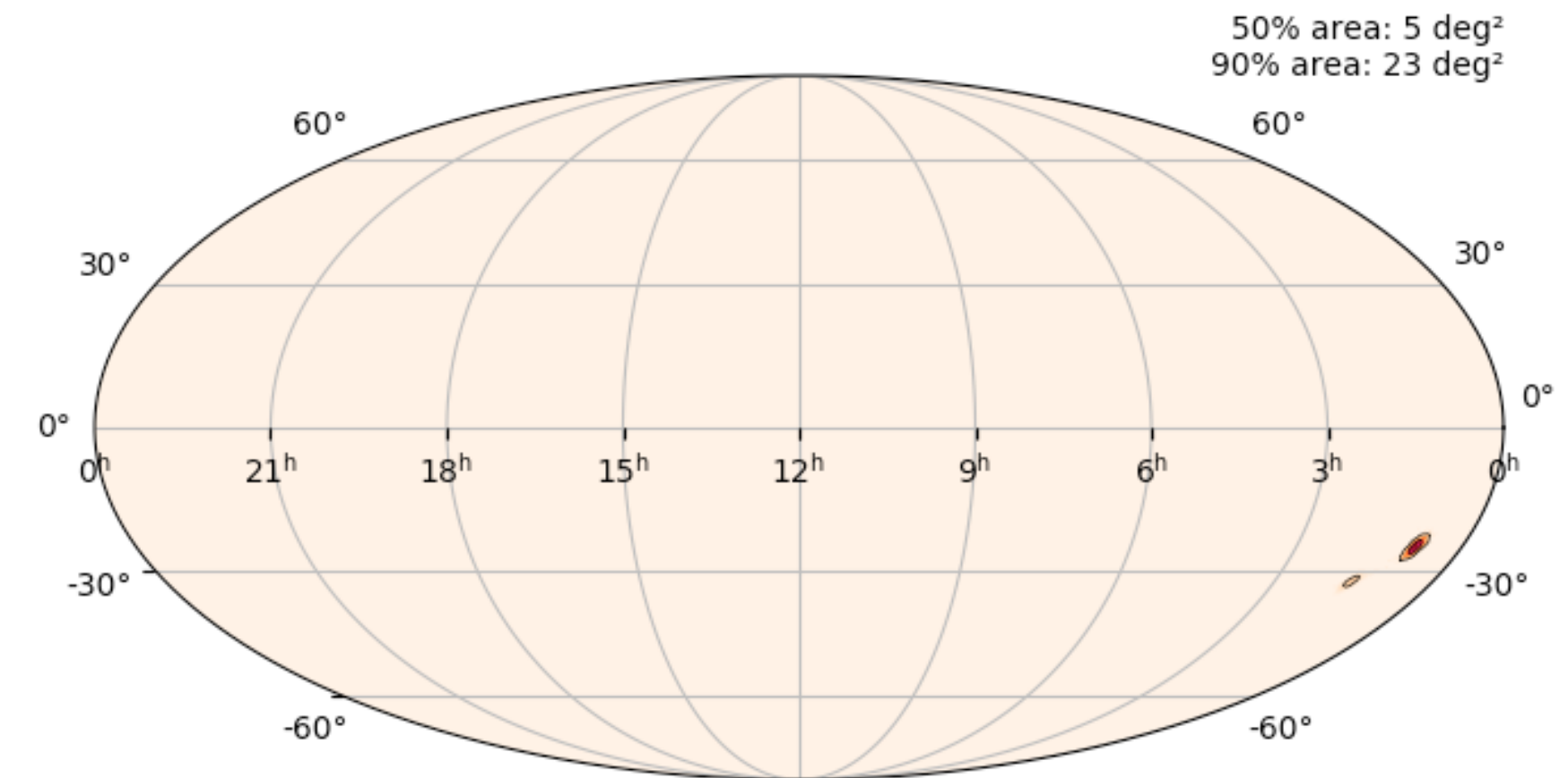


# Error regions

$\sim 10^3 \text{ deg}^2$



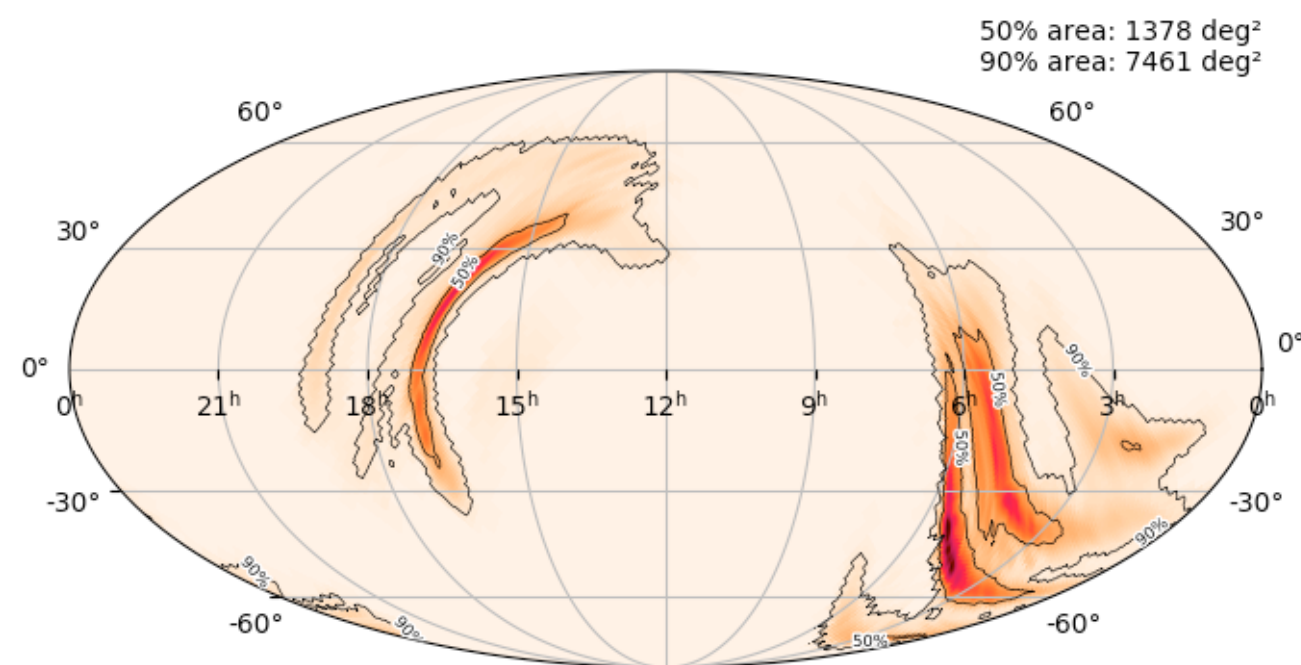
$\sim 10 \text{ deg}^2$



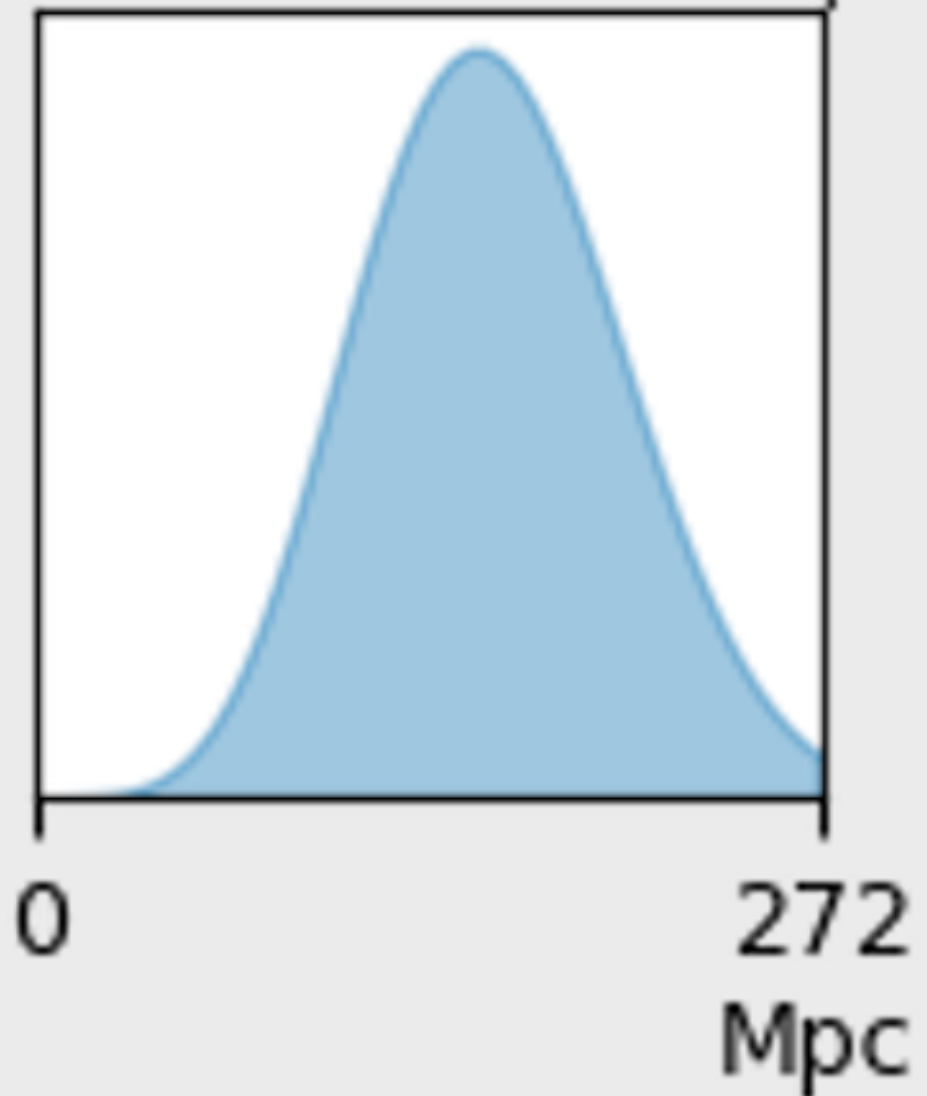
Credits: LVK

# Distances

$\sim 10^3 \text{ deg}^2$

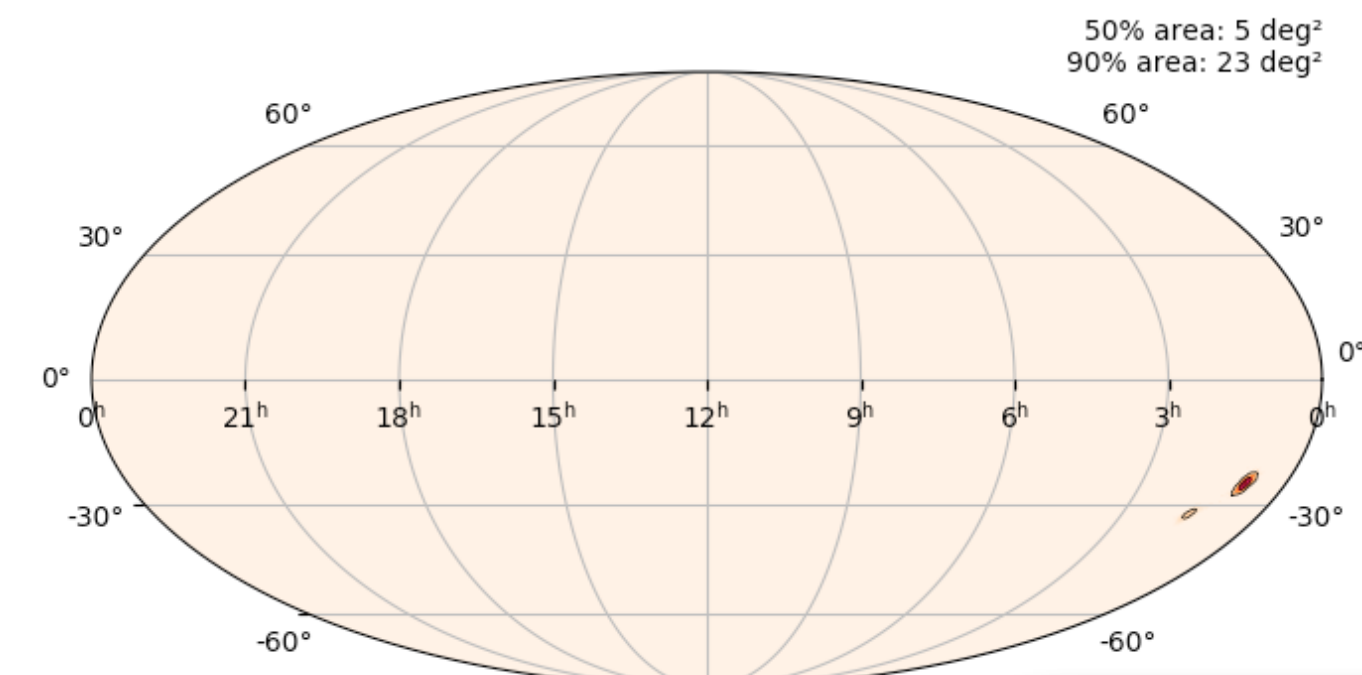


distance:  $157 \pm 43$  Mpc

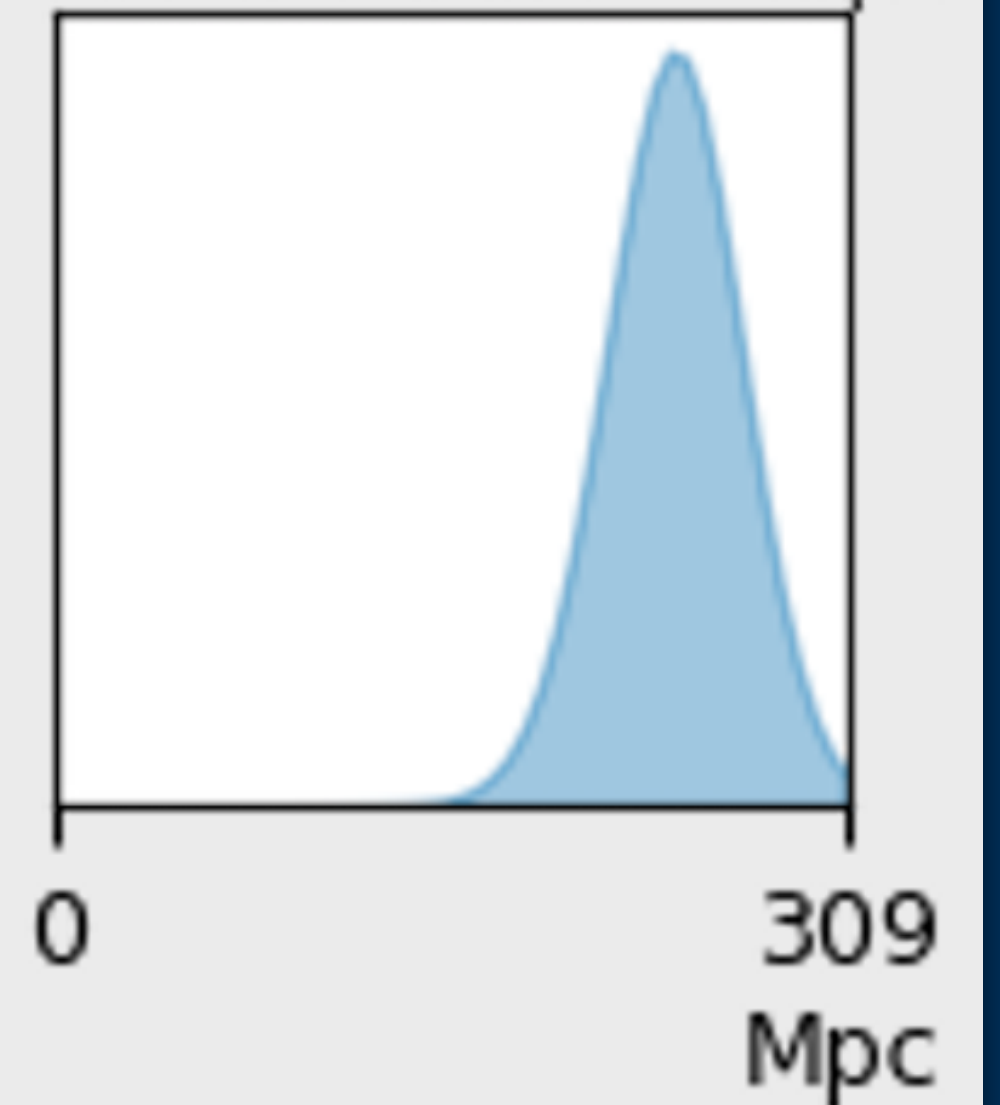


Credits: LVK

$\sim 10 \text{ deg}^2$



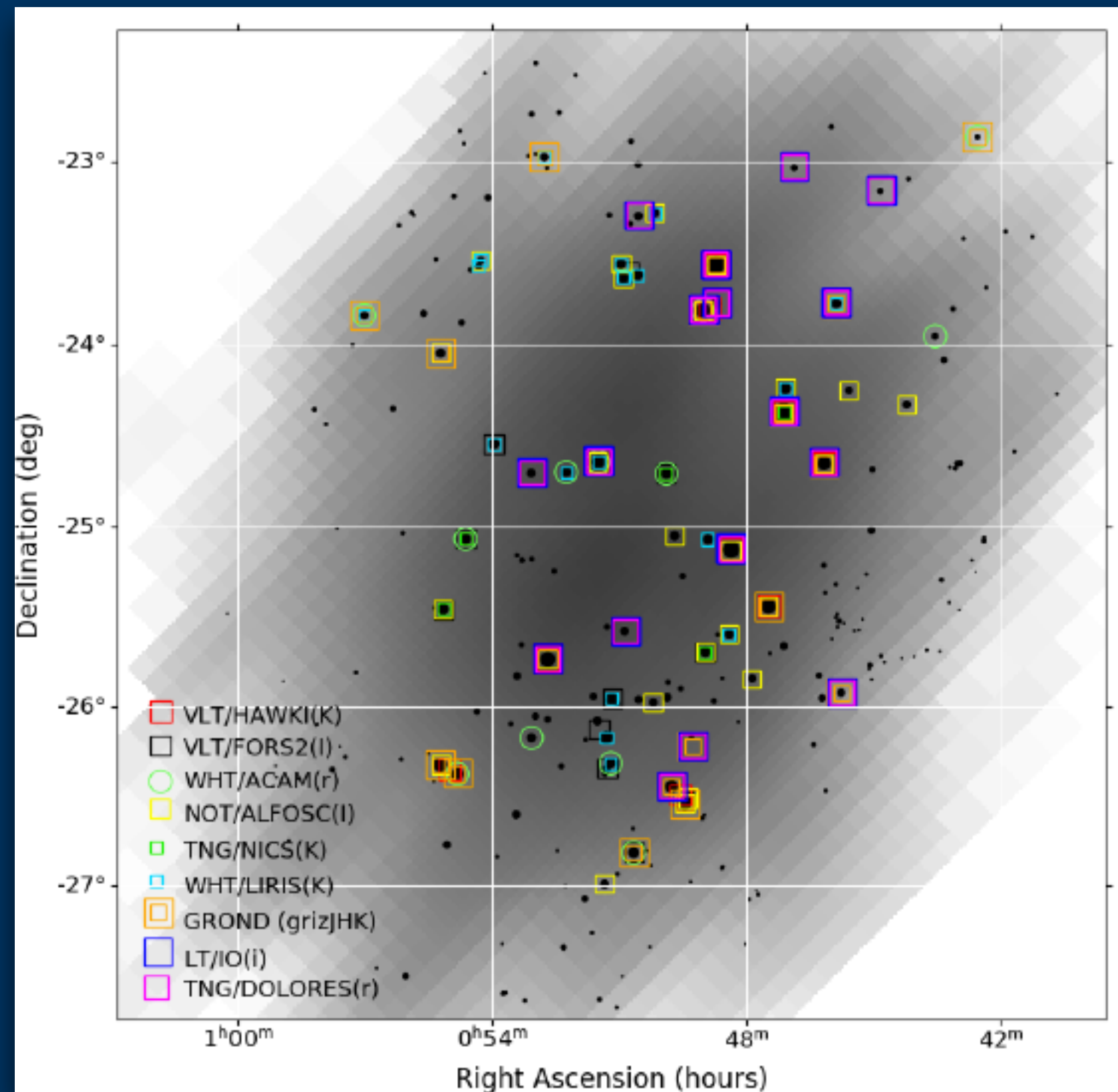
distance:  $241 \pm 26$  Mpc



Credits: LVK



# Scanning regions / Targeting galaxies



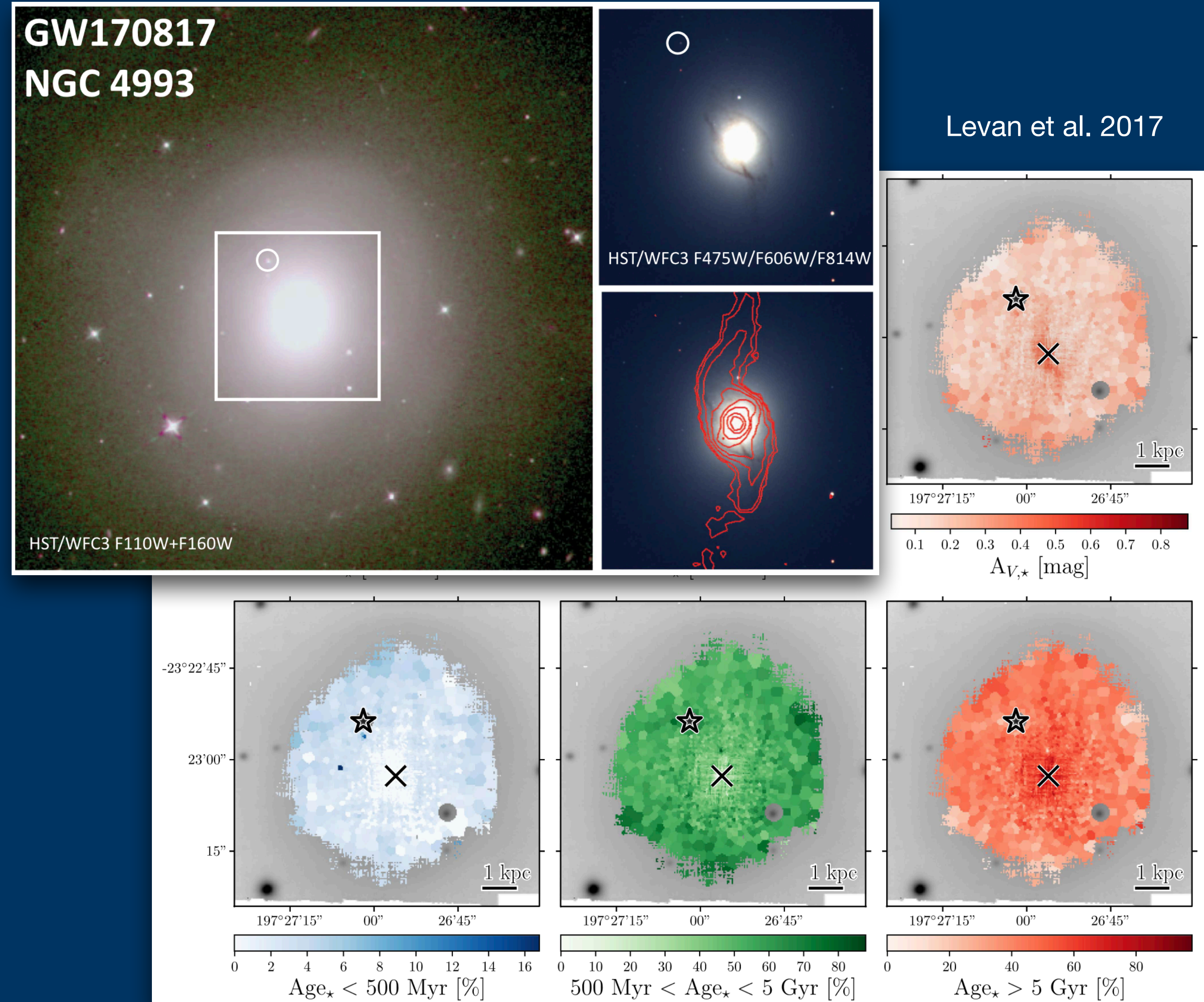
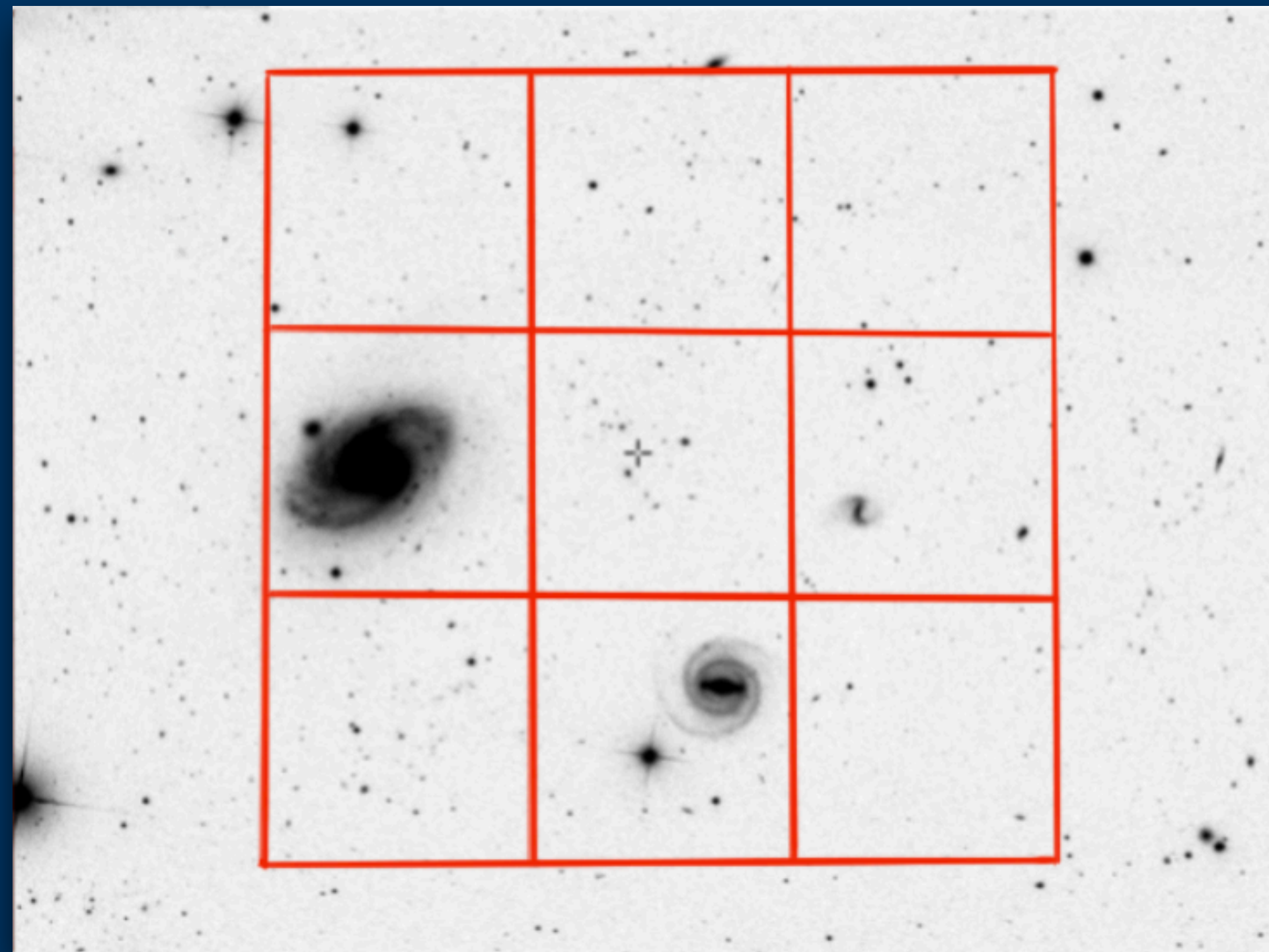
Ackley et al. 2020

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# Advantages: more galaxies & environment

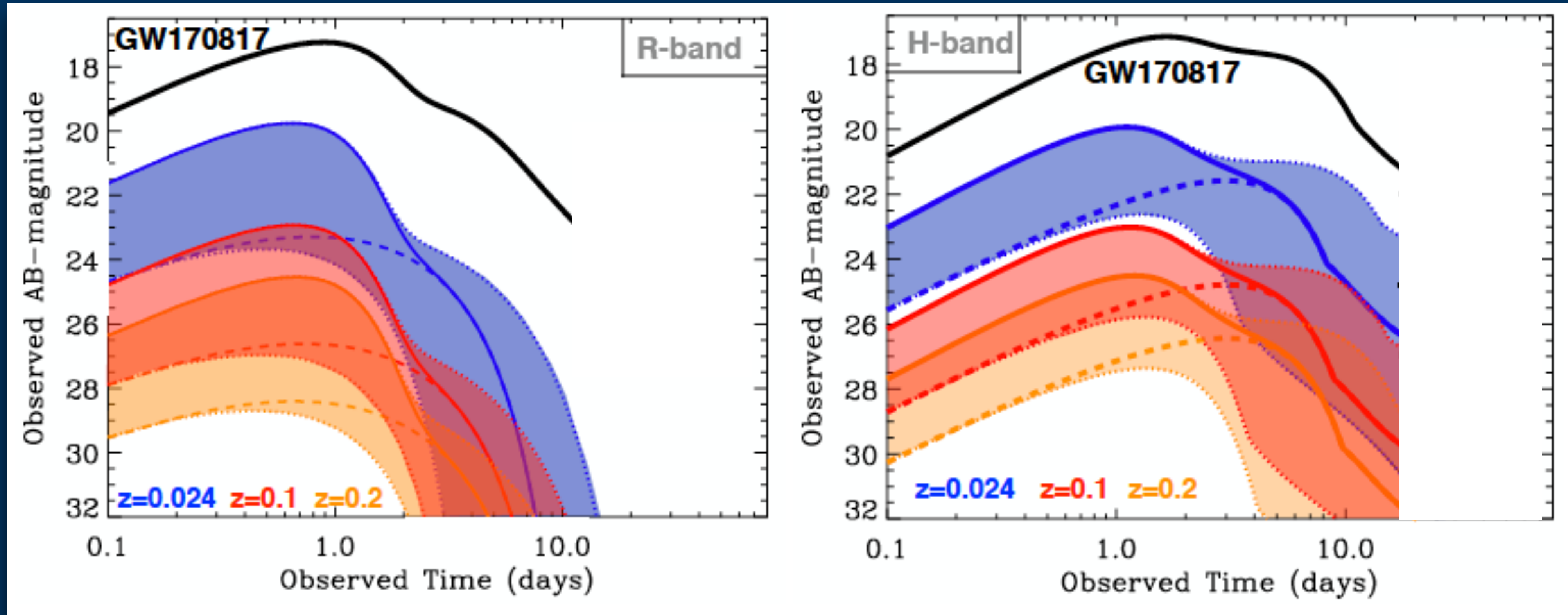
WST White Paper 2024





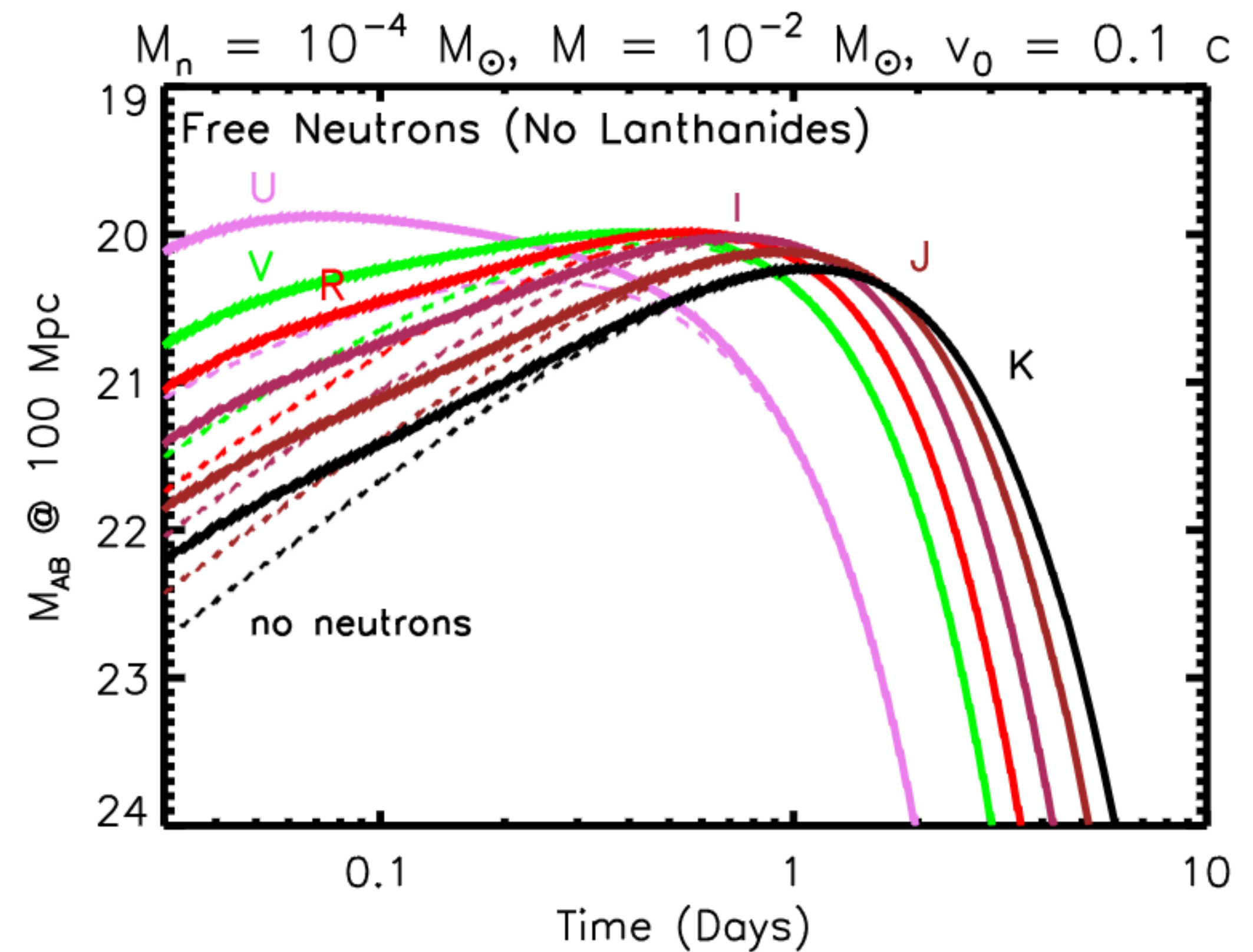
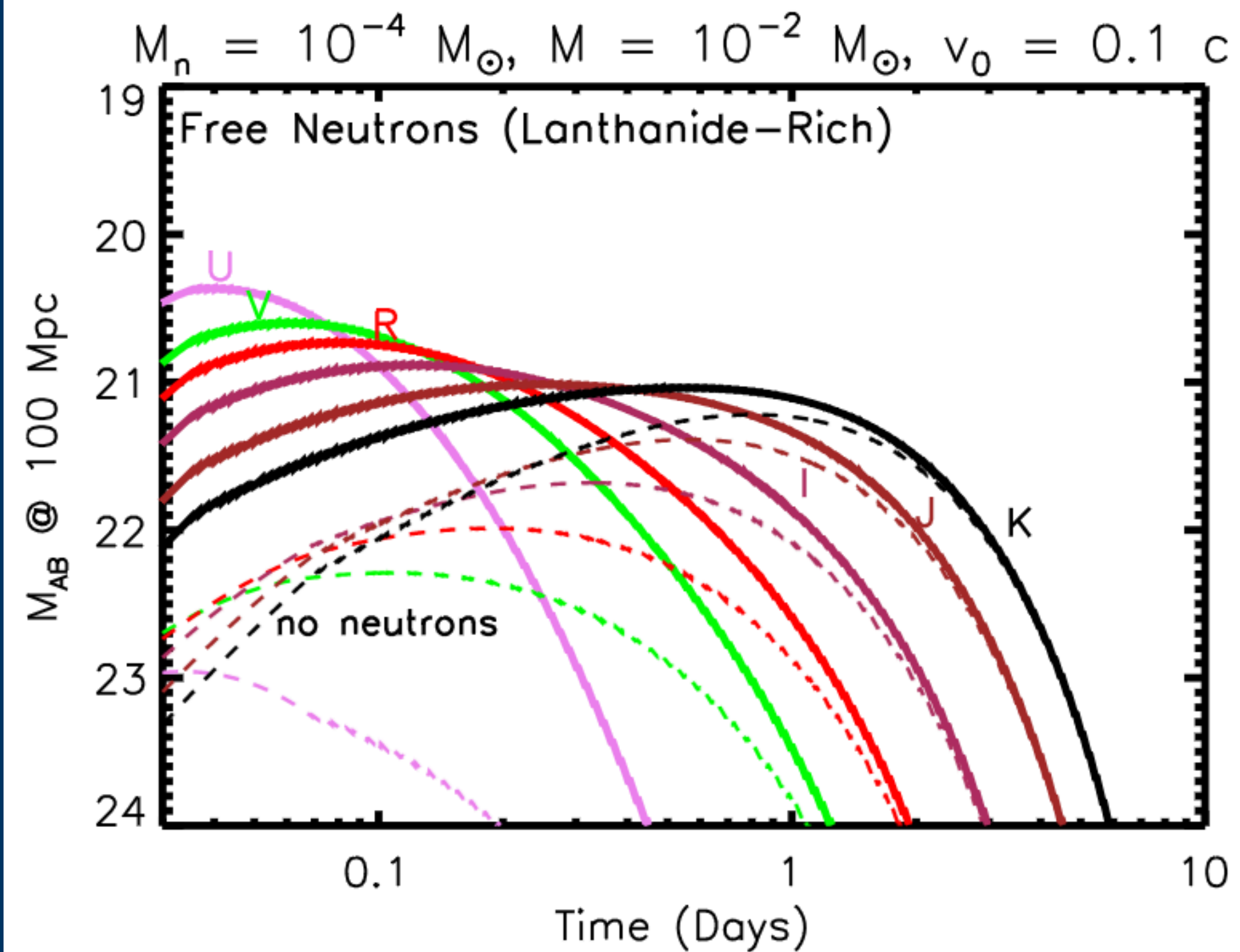
# Faint!

adapted from Chornock+2019



# Faint!

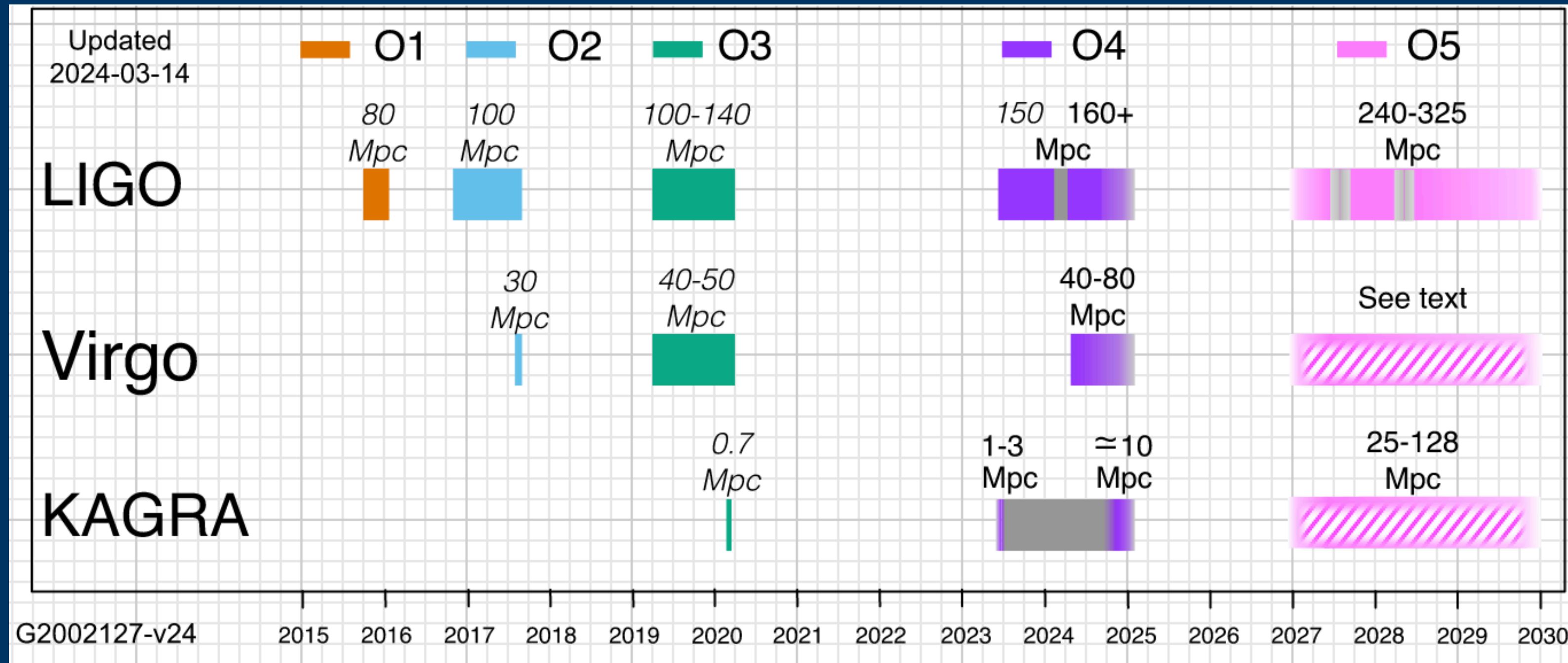
Metzger 2020





# LVK $\rightarrow$ O5 (& after)

Credits: LVK



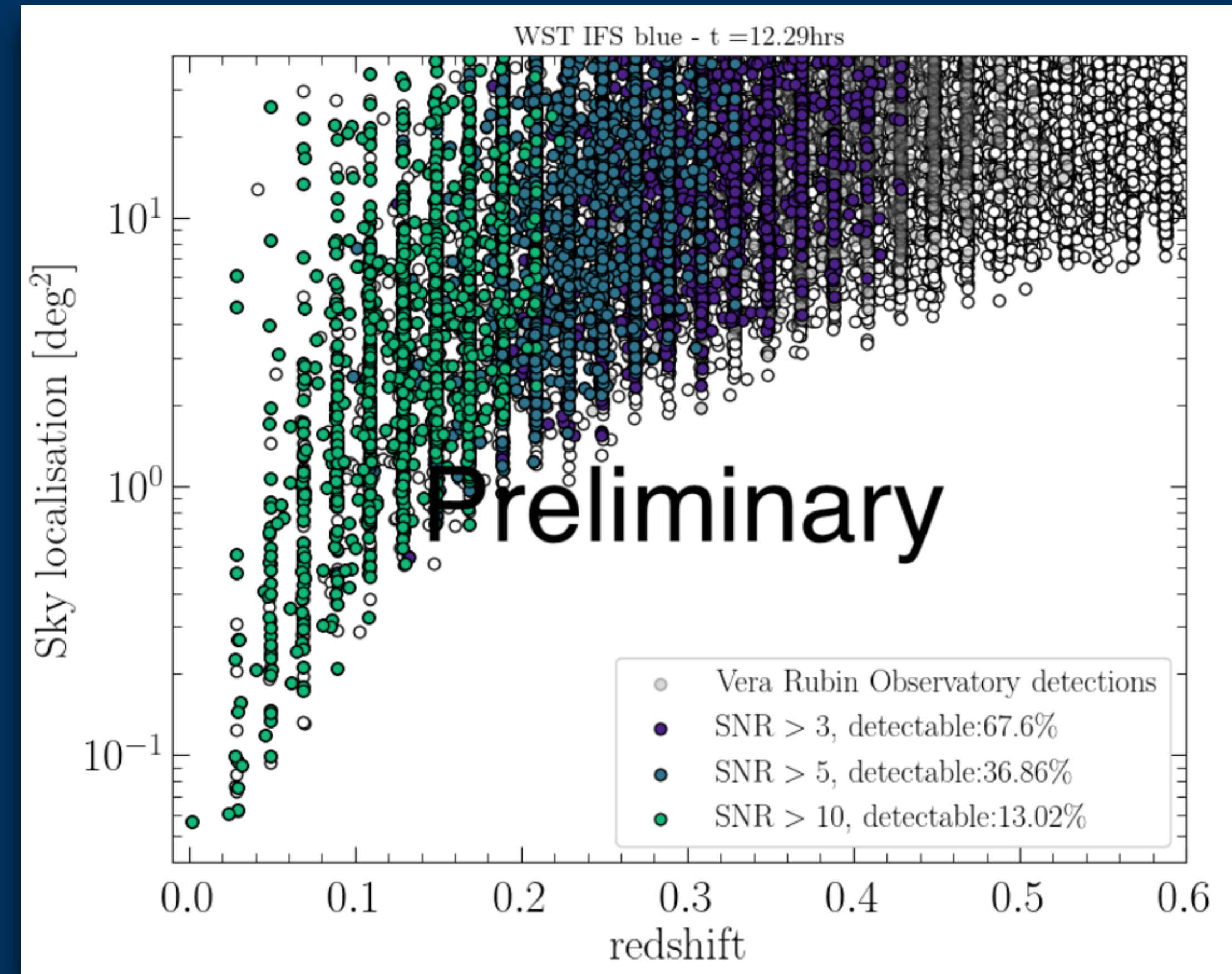
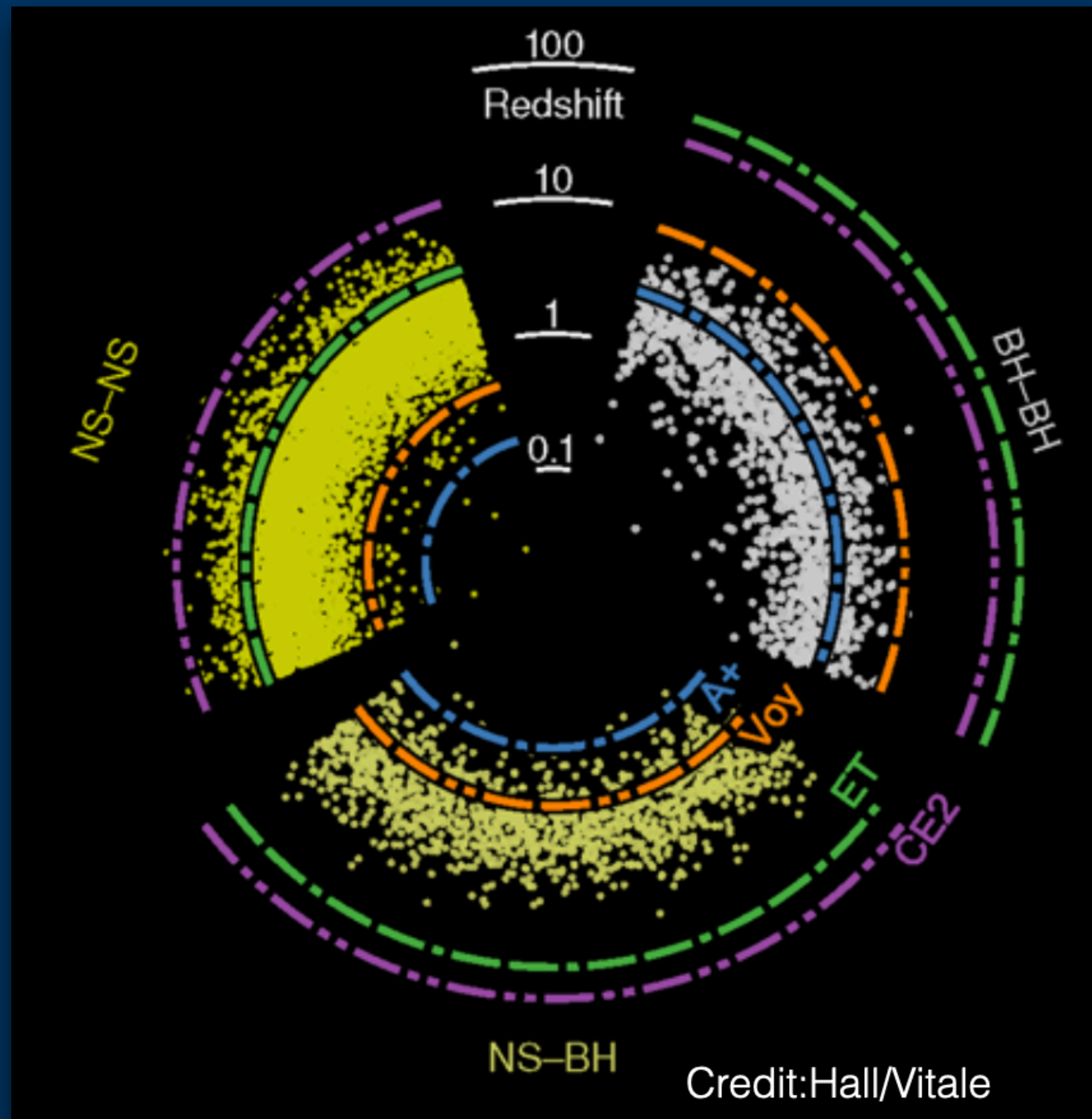
Farther

Smaller error regions for the same distances



# Einstein Telescope (ET)

WST White Paper 2024



Focus on nearby objects : better localized & brighter



# Conclusions

- BlueMUSE very interesting to look for the UV-blue component of KN
- FoV: more galaxies in one shot / study of the KN environment
- Need to be very rapid: react on GW alert without waiting for counterpart candidates identification
- UV satellites may (partly) do that: ULTRASAT & UVEX



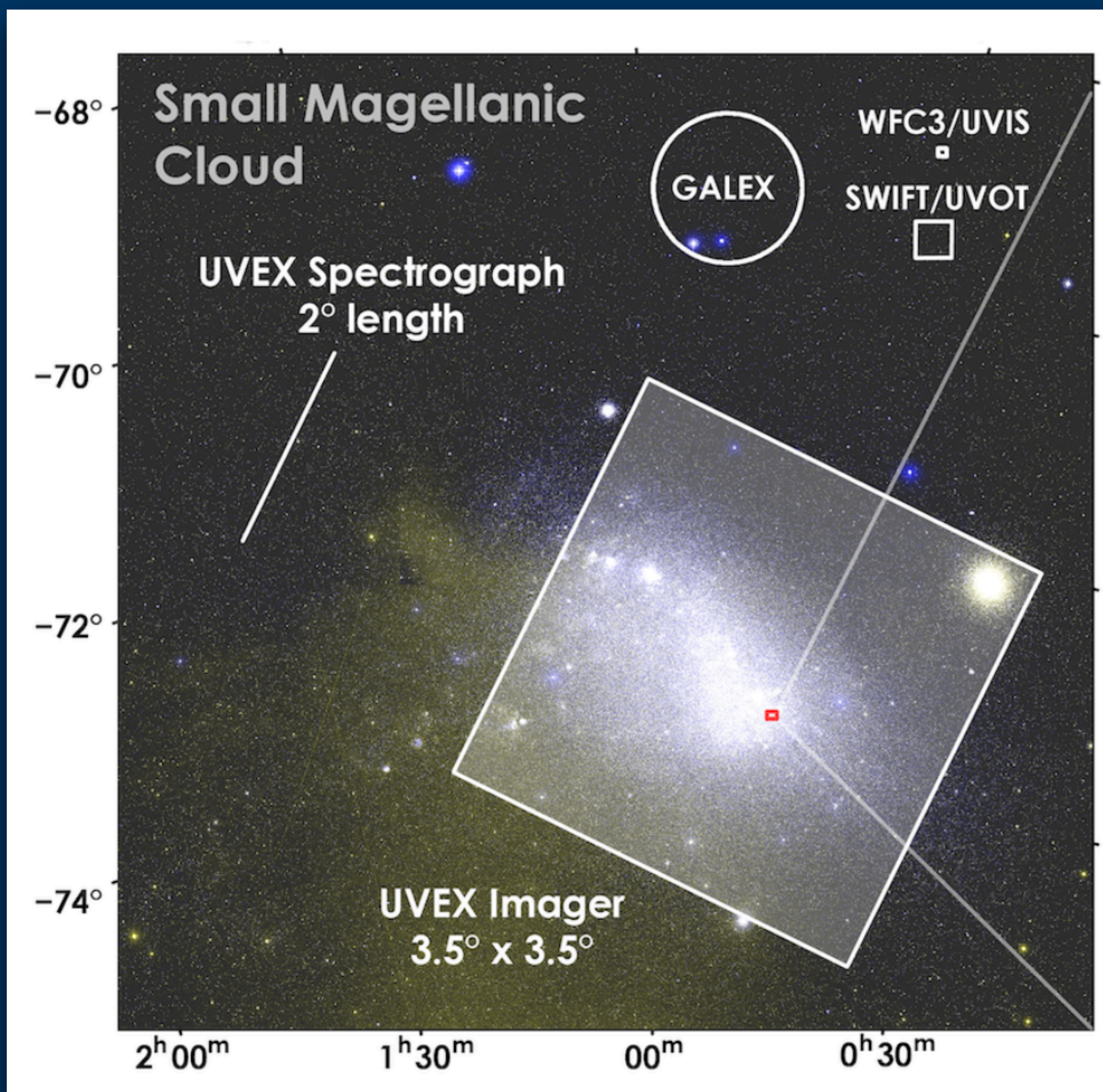
# ULTRASAT



Property	Value	Comments
Mission lifetime	3 years	Propellent for 6 years
Orbit	GEO	
Total FoV	204 deg <sup>2</sup>	Covered by 4 dies
Operation waveband	230-290 nm	
Cadence	300 s	For the high cadence survey
Mean effective PSF	8.3"	In central 170 deg <sup>2</sup> For T = 20,000 K blackbody source
Mean limiting magnitude (in 900s, 5σ)	22.4 ABmag	In central 170 deg <sup>2</sup> For T = 20,000 K blackbody source
Real-time download of data	Continuous	
Transient alert after image capture	< 15 min	For both survey and ToO modes
Sky accessibility at any given moment	> 50%	
Observation start after ToO trigger	< 15 min	At any visible position



# UVEX



## UVEX Mission Parameters

Science Mission	Launch: 2030 duration 2 years
Imaging FOV	$3.5^\circ \times 3.5^\circ$
Image Quality (HPD)	$< 2.25''$
Imaging Bandpass	FUV: 1390–1900 Å NUV: 2030–2700 Å
Sky Survey Depth	$> 25.8$ mag (FUV and NUV)
Spectrograph	$2^\circ$ -long slit, multiple widths
Spectrograph Bandpass	1150–2650 Å
Spectrograph Resolution	$R > 1000$
Orbit	Elliptical $17 R_E \times 59 R_E$ , 13.7 days
Instantaneous Sky Accessibility	$> 70\%$
Average ToO Response	$< 3$ hours



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