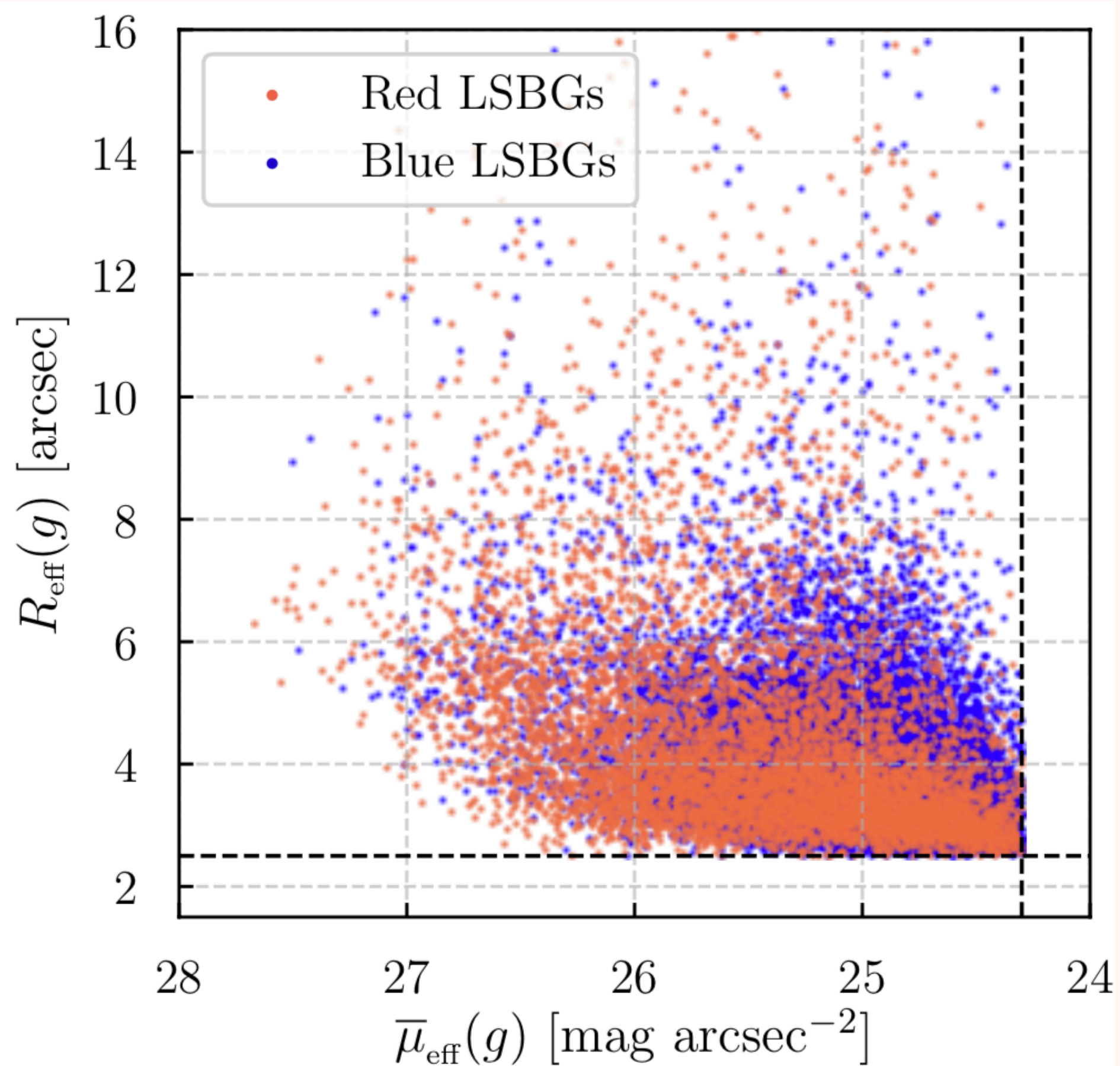


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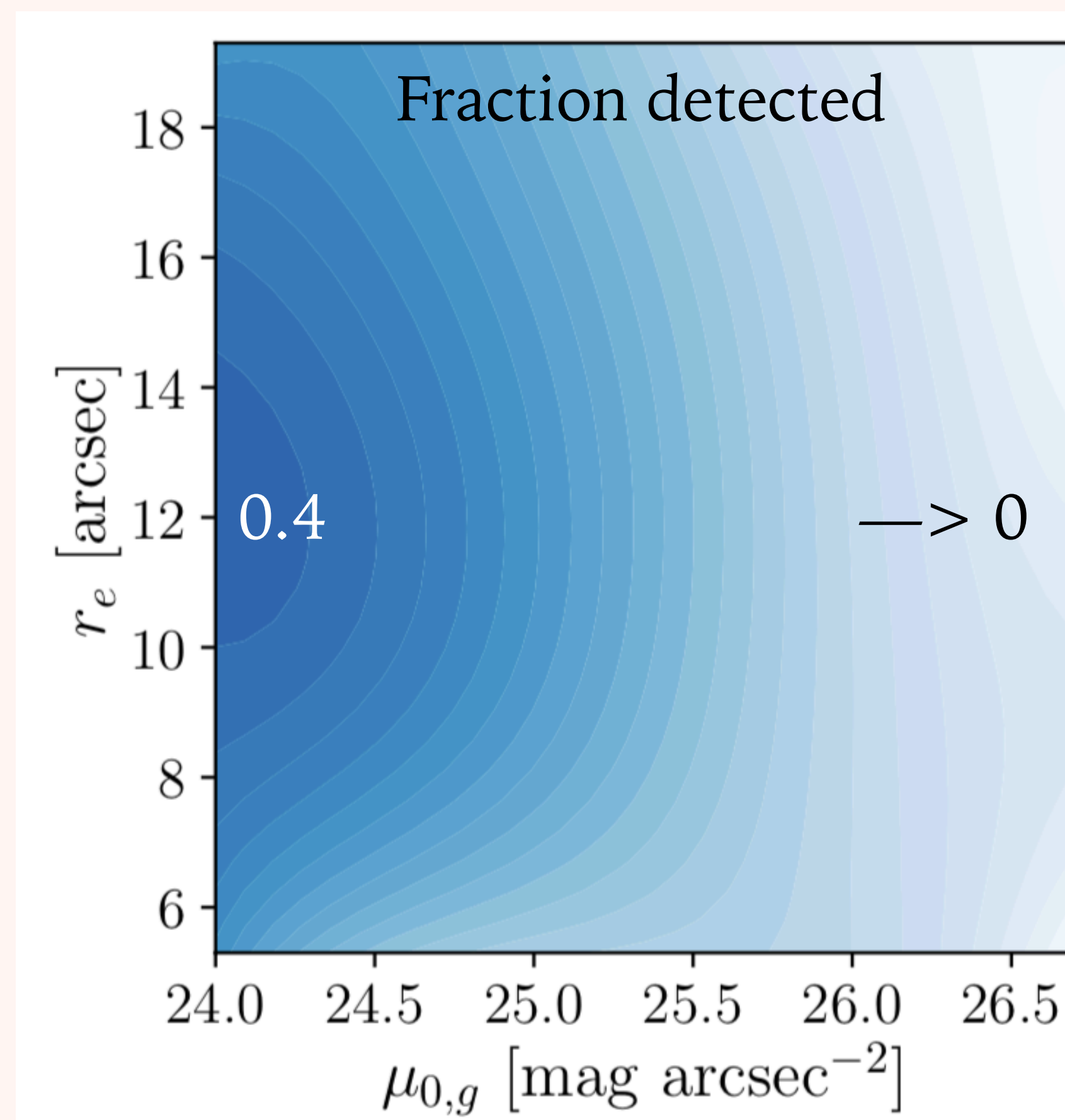
**Zili Shen, Pieter van Dokkum, and the Dragonfly team**

# **NEARBY DIFFUSE GALAXIES IN THE DRAGONFLY ULTRAWIDE SURVEY**

# HAVE THE BIGGEST LSB GALAXIES BEEN FOUND?



Tanoglidis+2021



Zaritsky+2021

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# WHAT ARE THE BIGGEST LSB GALAXIES?

Select: large apparent size  
+ Distance



Dwarf



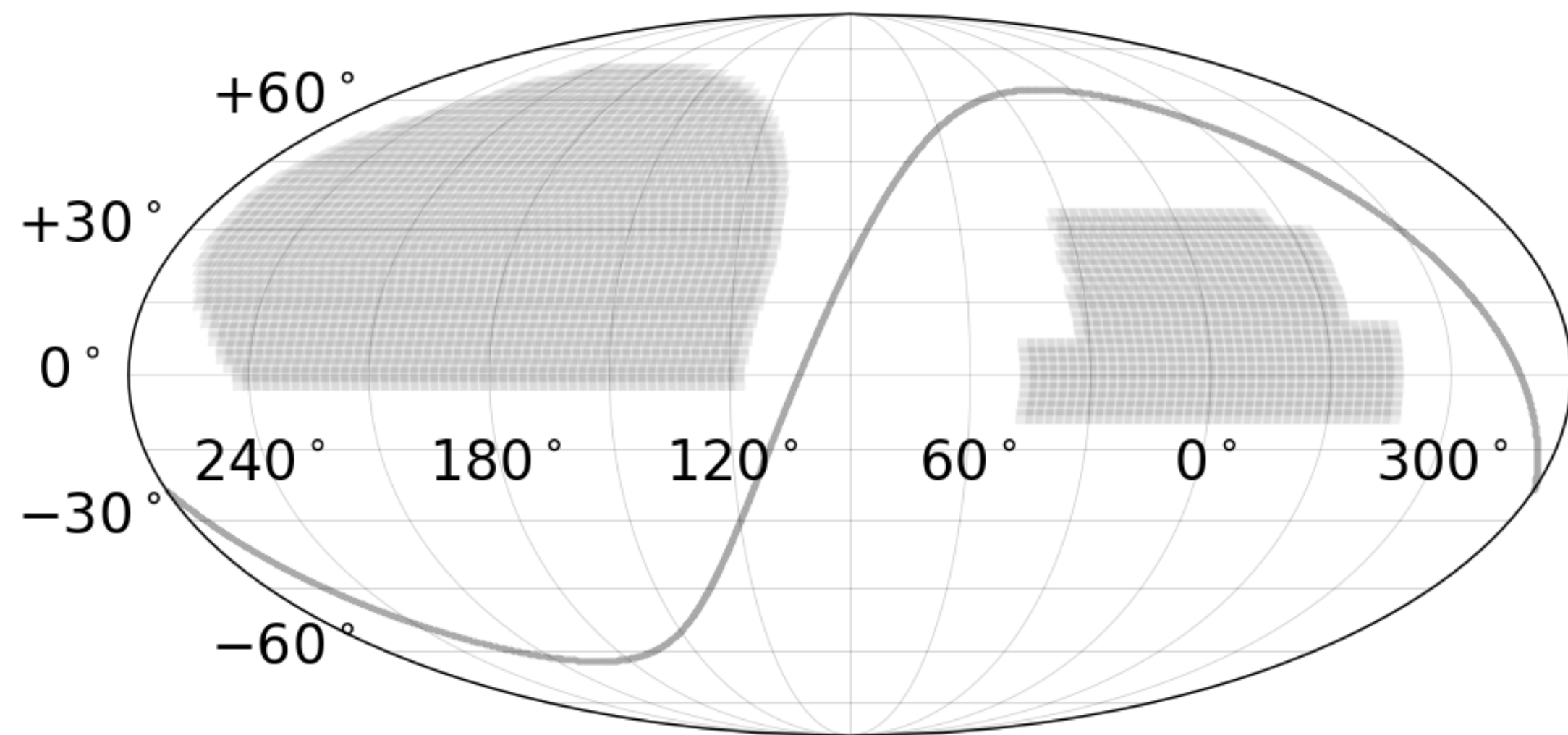
UDG

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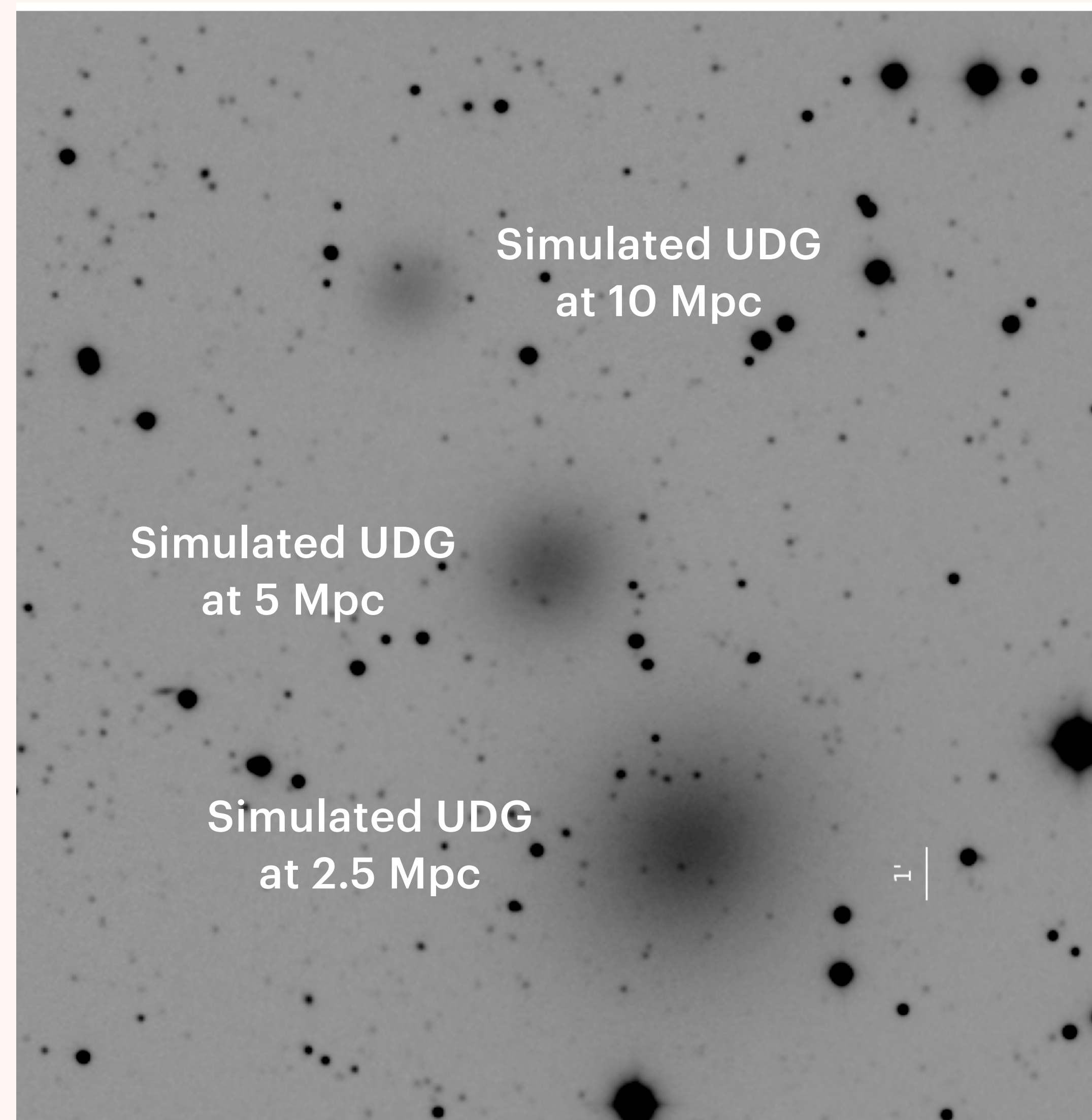
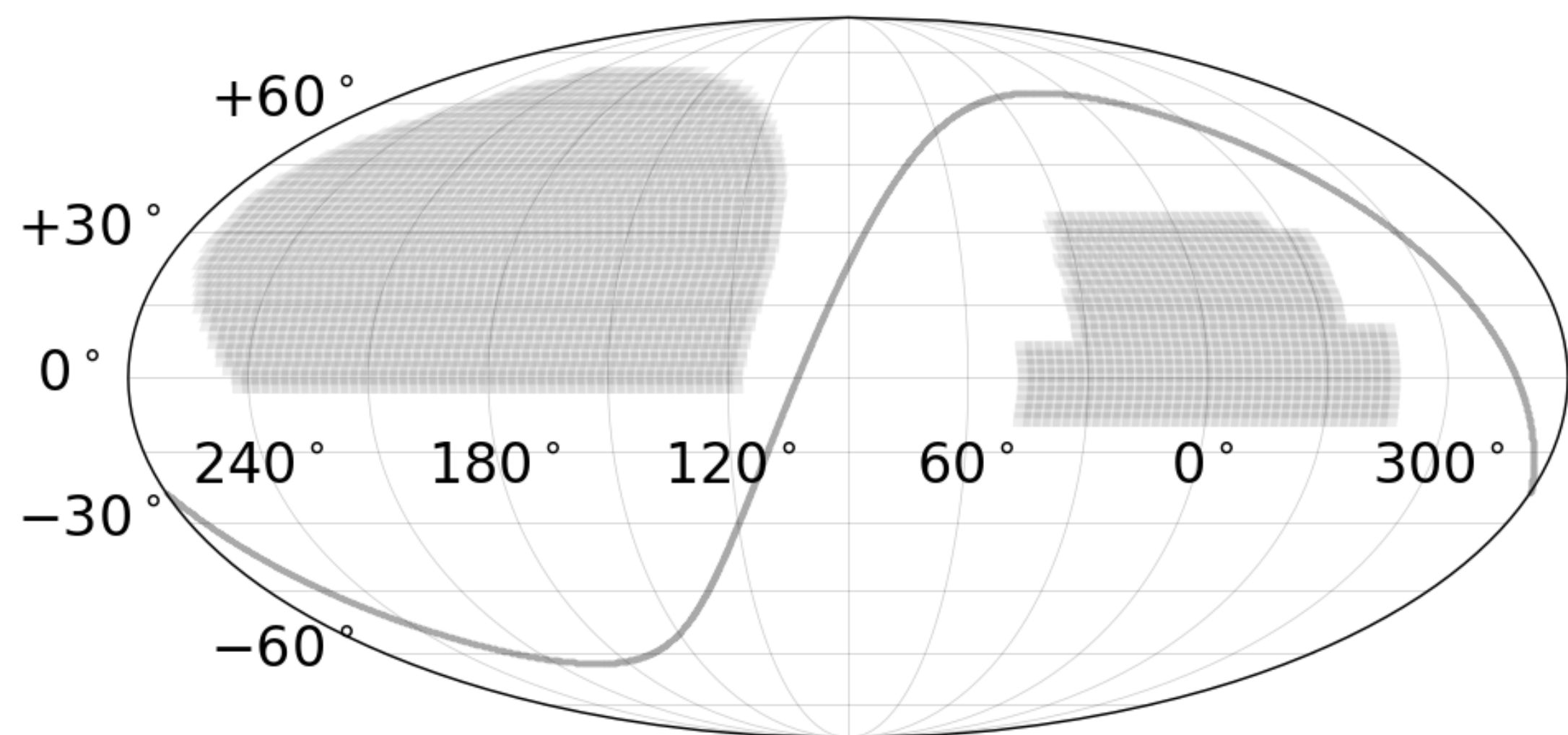
# DRAGONFLY ULTRAWIDE SURVEY (DFUWS)

Dragonfly Ultrawide Survey Coverage



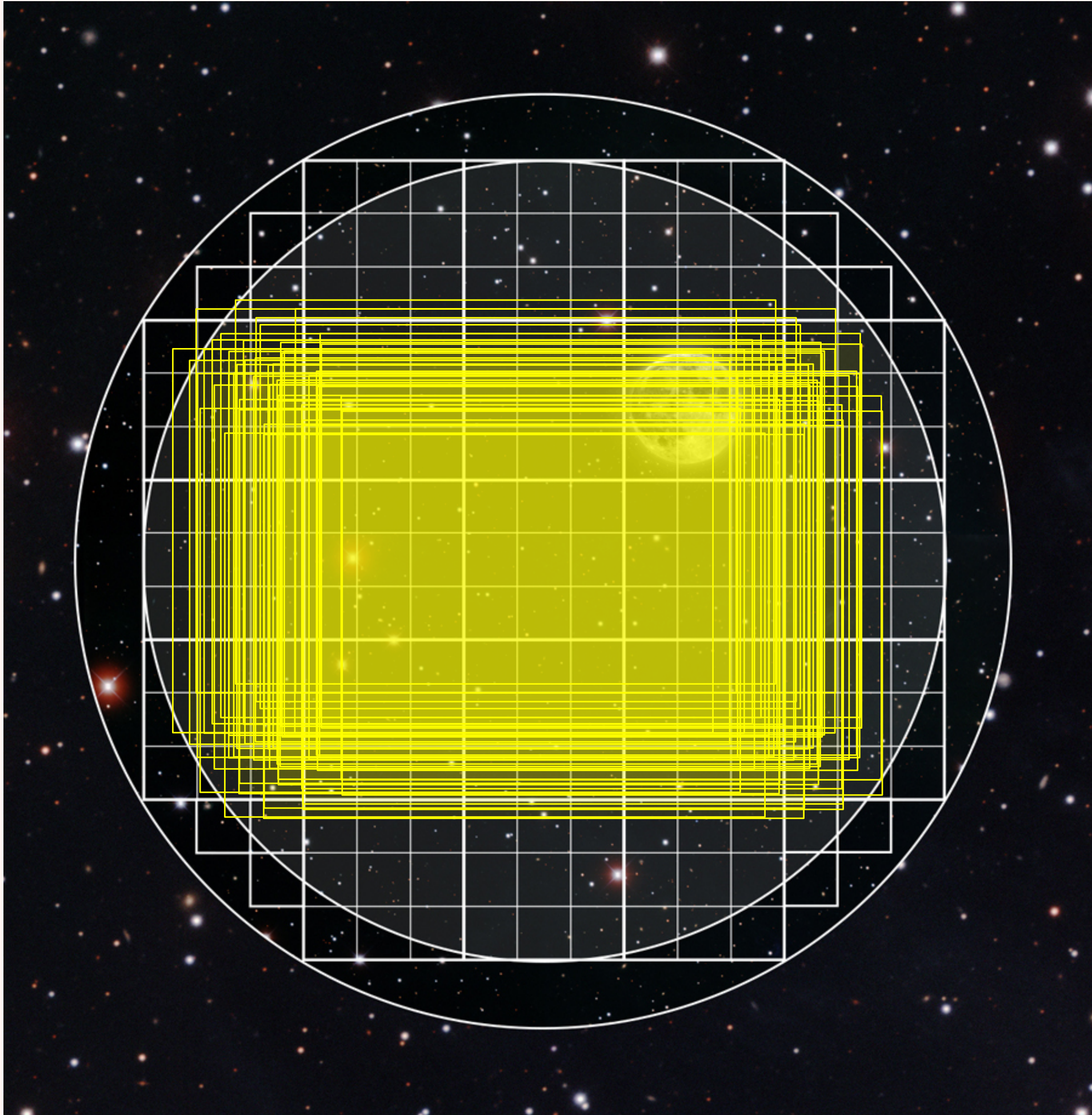
# DRAGONFLY ULTRAWIDE SURVEY (DFUWS)

Dragonfly Ultrawide Survey Coverage

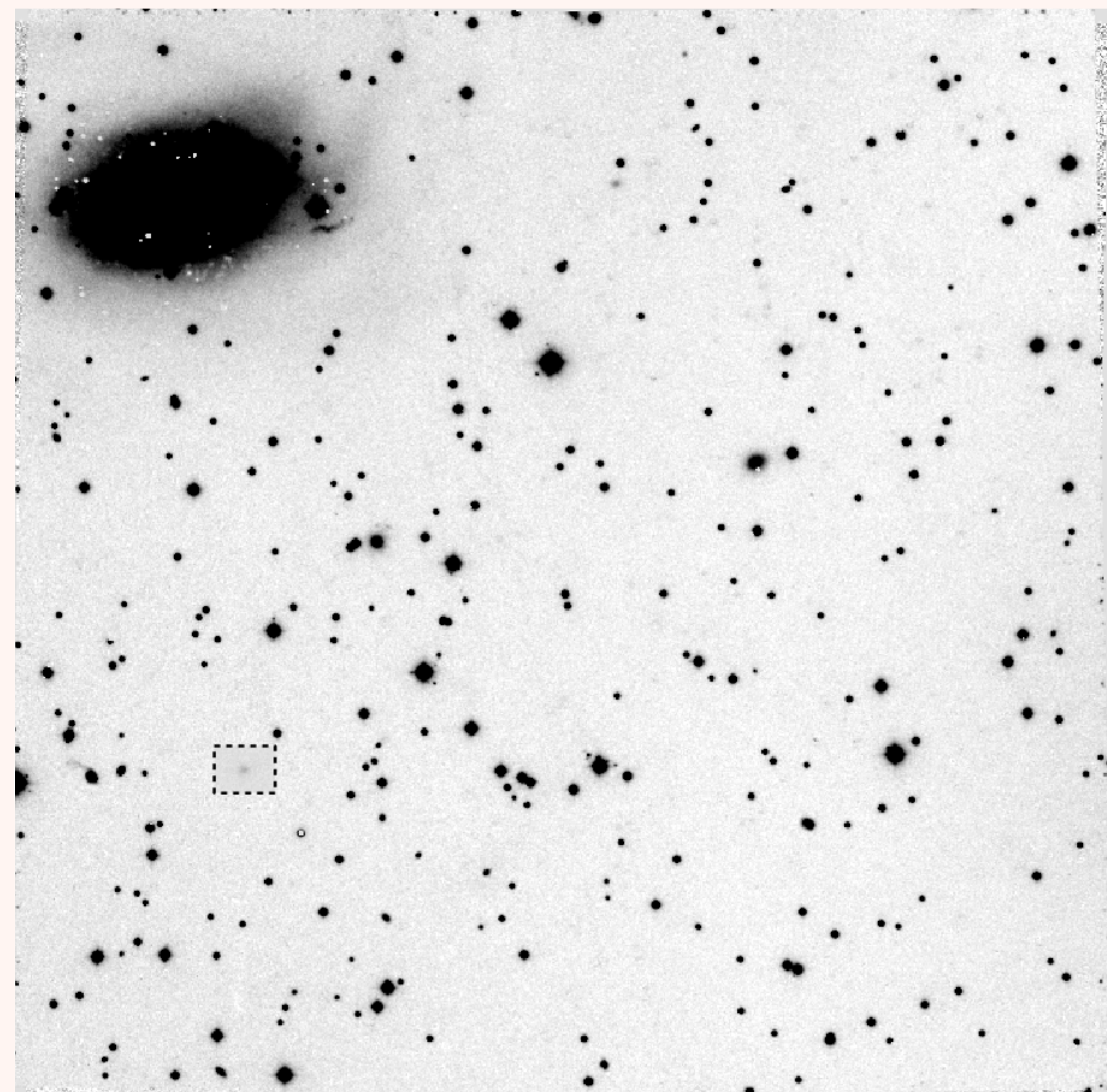


# DFUWS FACTS

|                            |                                  |
|----------------------------|----------------------------------|
| Filters                    | SDSS g and r<br>(24 lenses each) |
| Exposure time              | 3 x 7min x 48 lenses             |
| Field of view per pointing | 3 x 2 degrees                    |
| Pixel scale                | 2.5"                             |
| 1-sigma SB at 60"          | 29.0 g-band<br>28.5 r-band       |

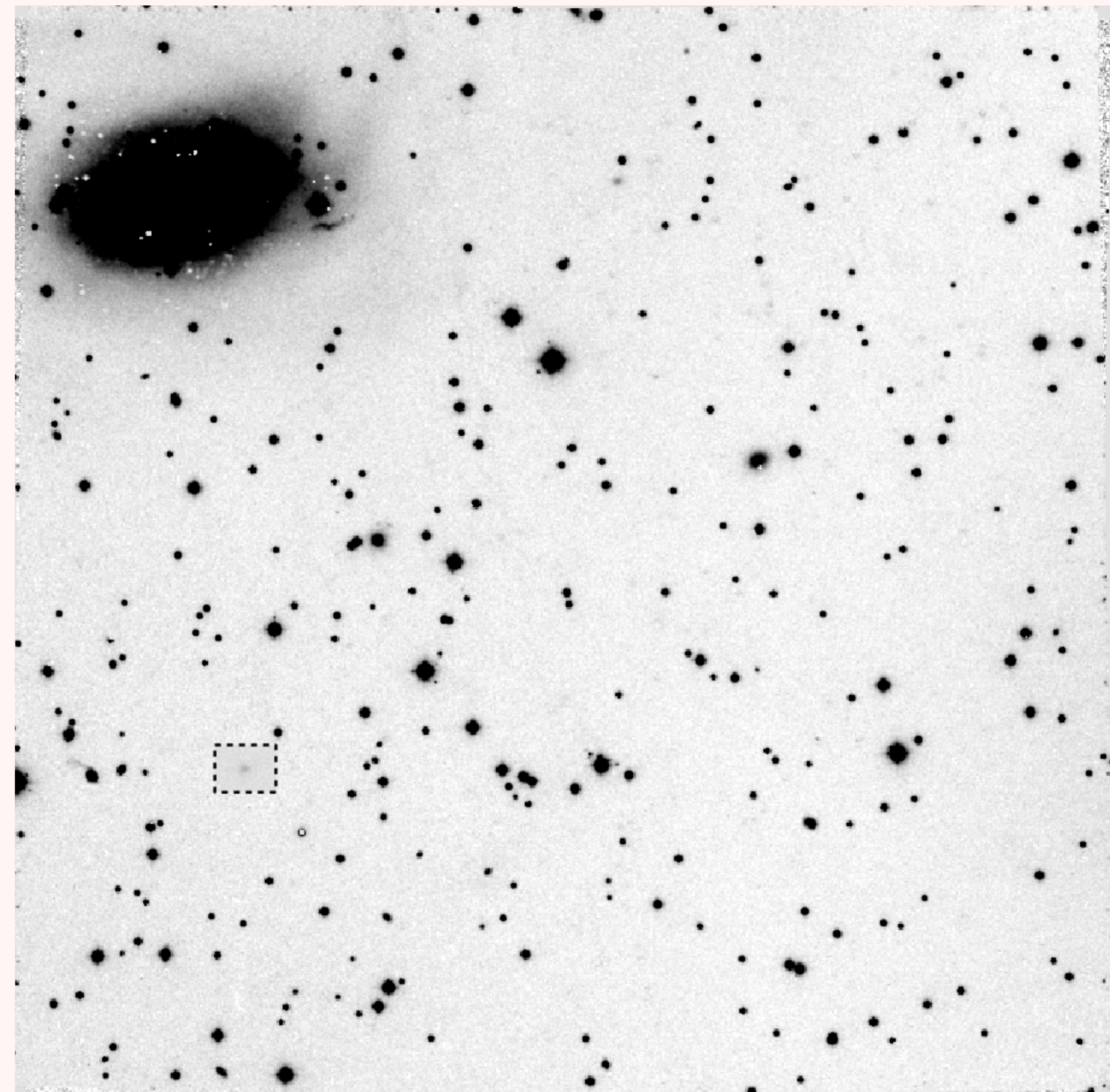


# DFUWS Data Product



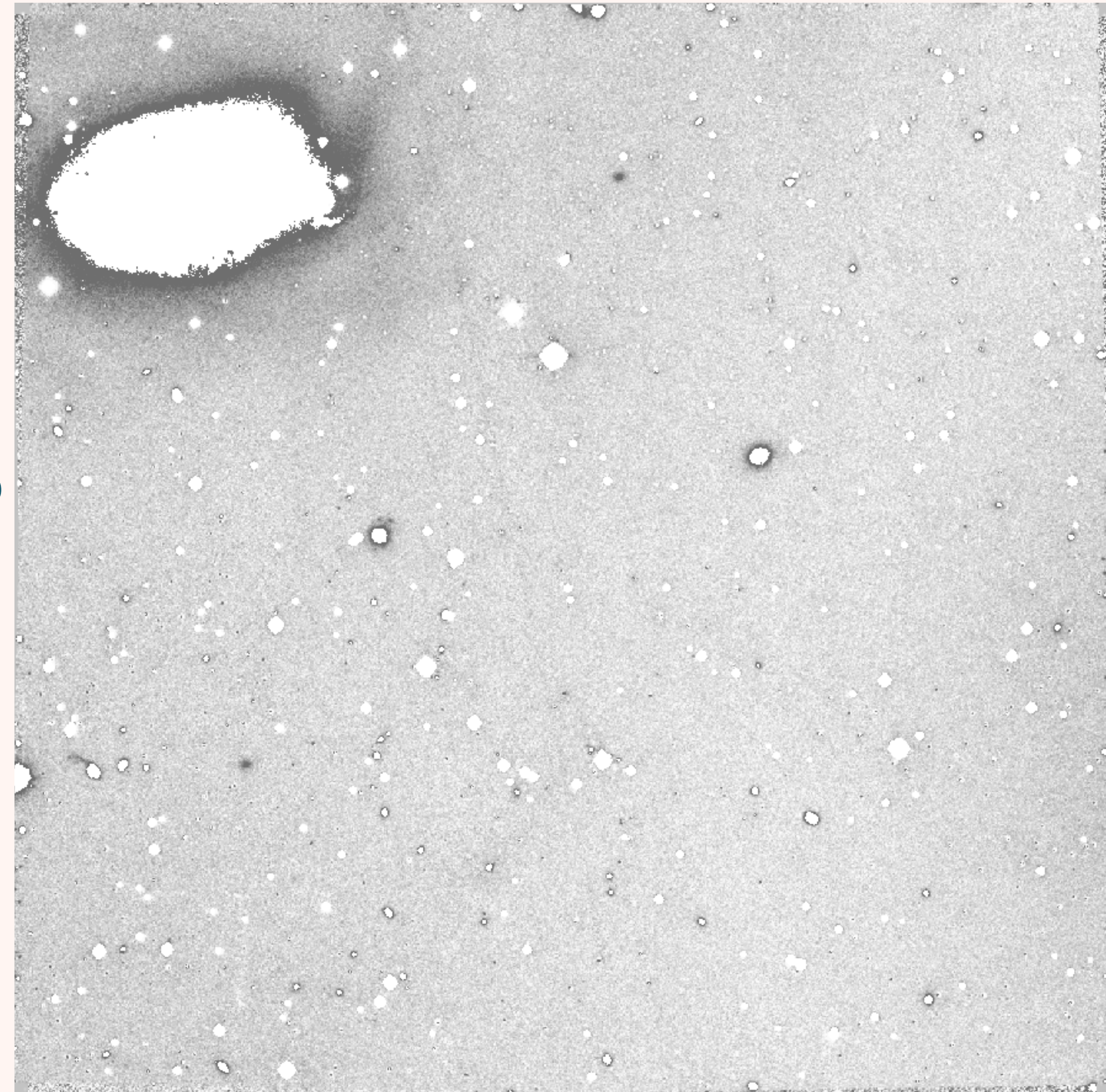
1 degree

**DFUWS Data Product**



1 degree

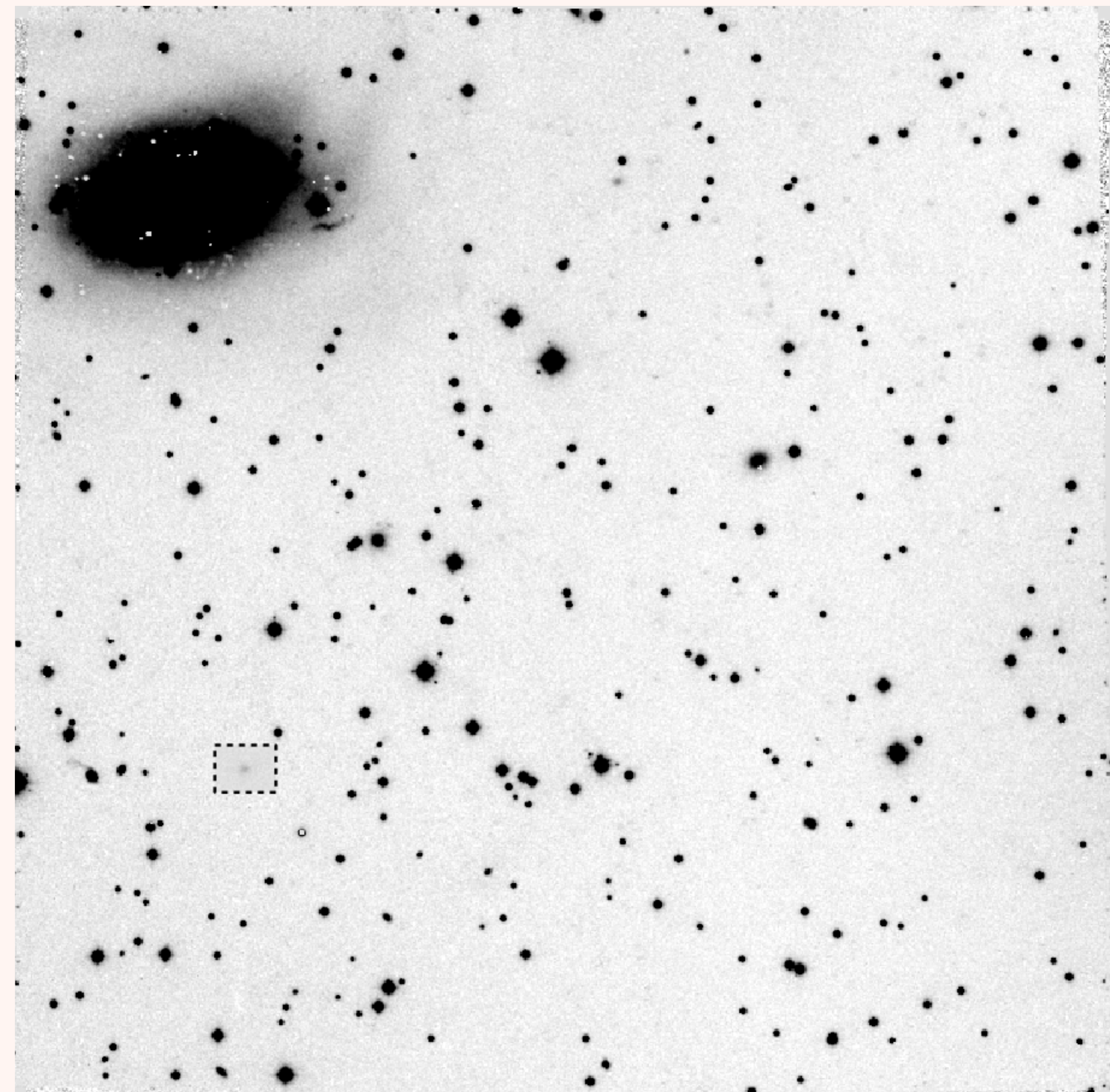
**After Multi-Resolution Filtering  
(MRF, van Dokkum+ 2020)**



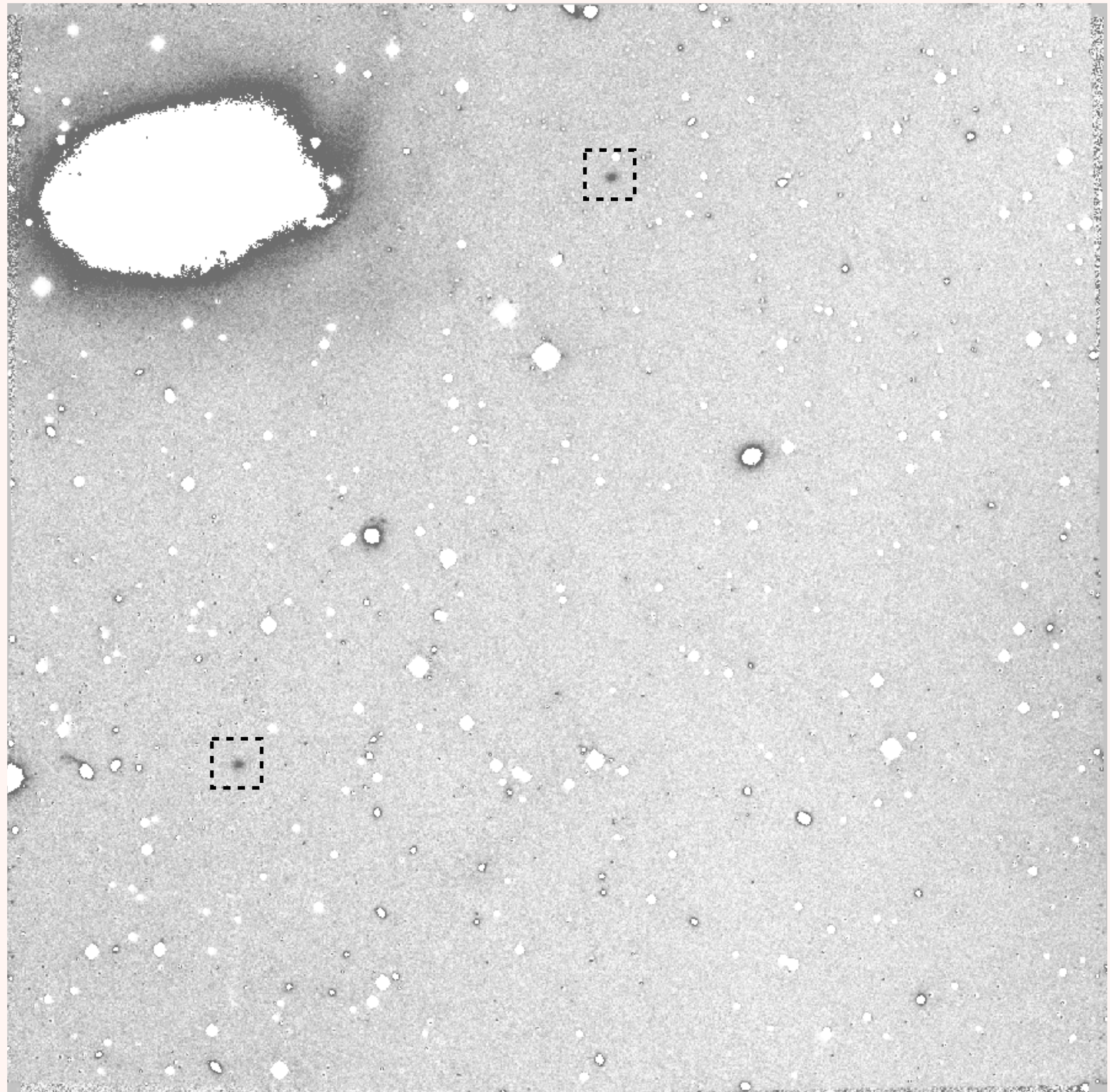


**DFUWS Data Product**

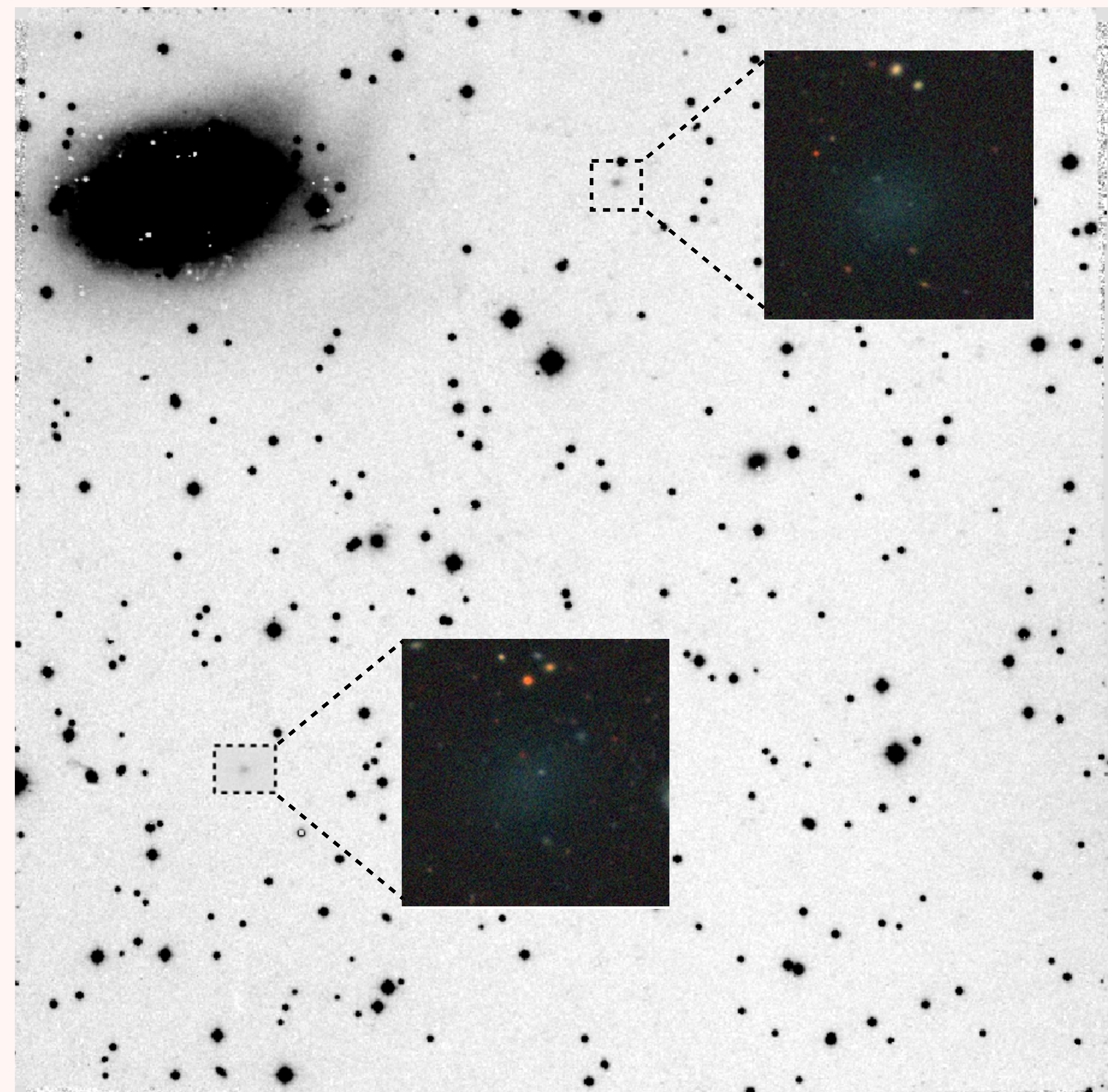
**After Multi-Resolution Filtering  
(MRF, van Dokkum+ 2020)**



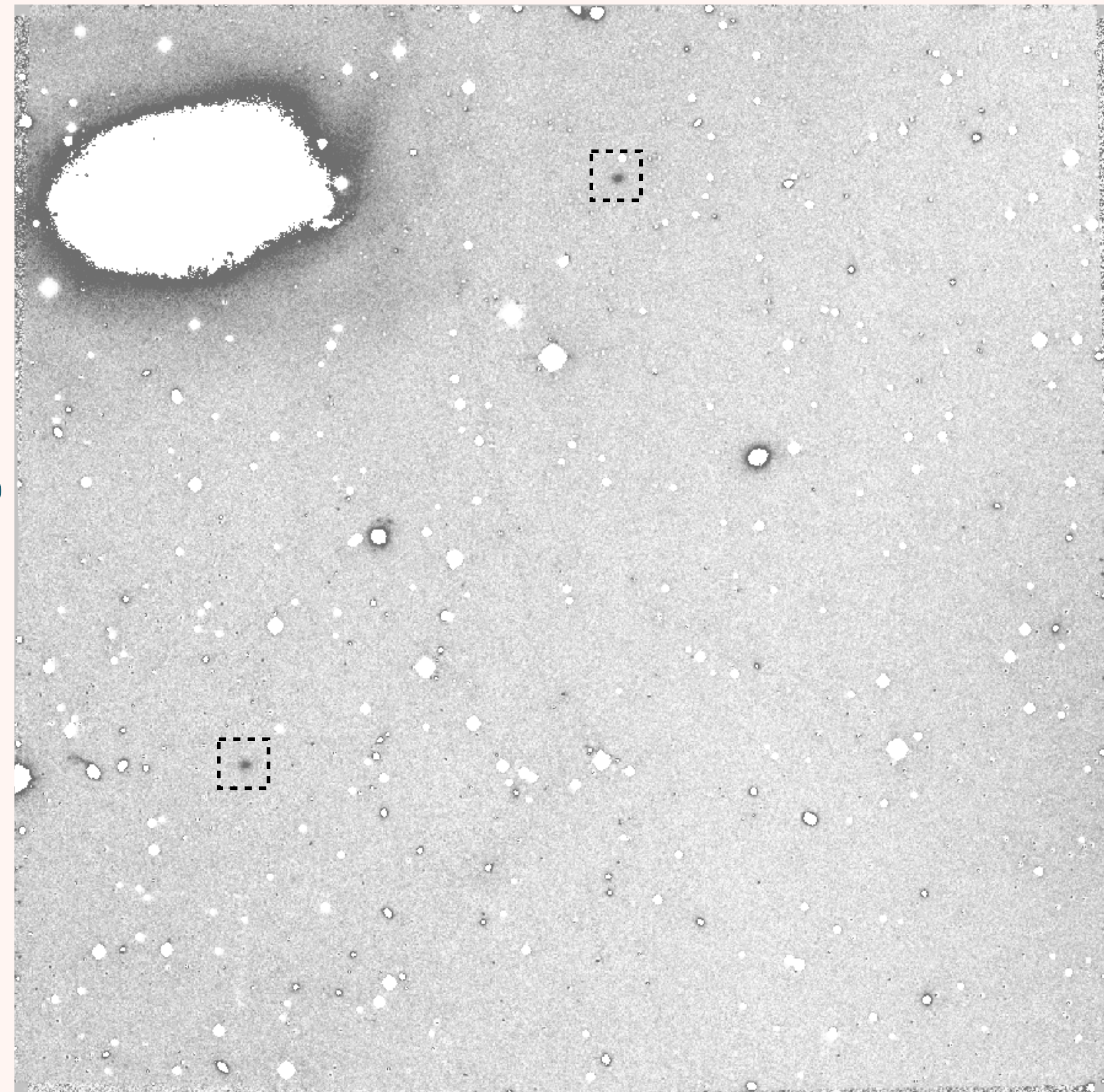
1 degree



**DFUWS Data Product**

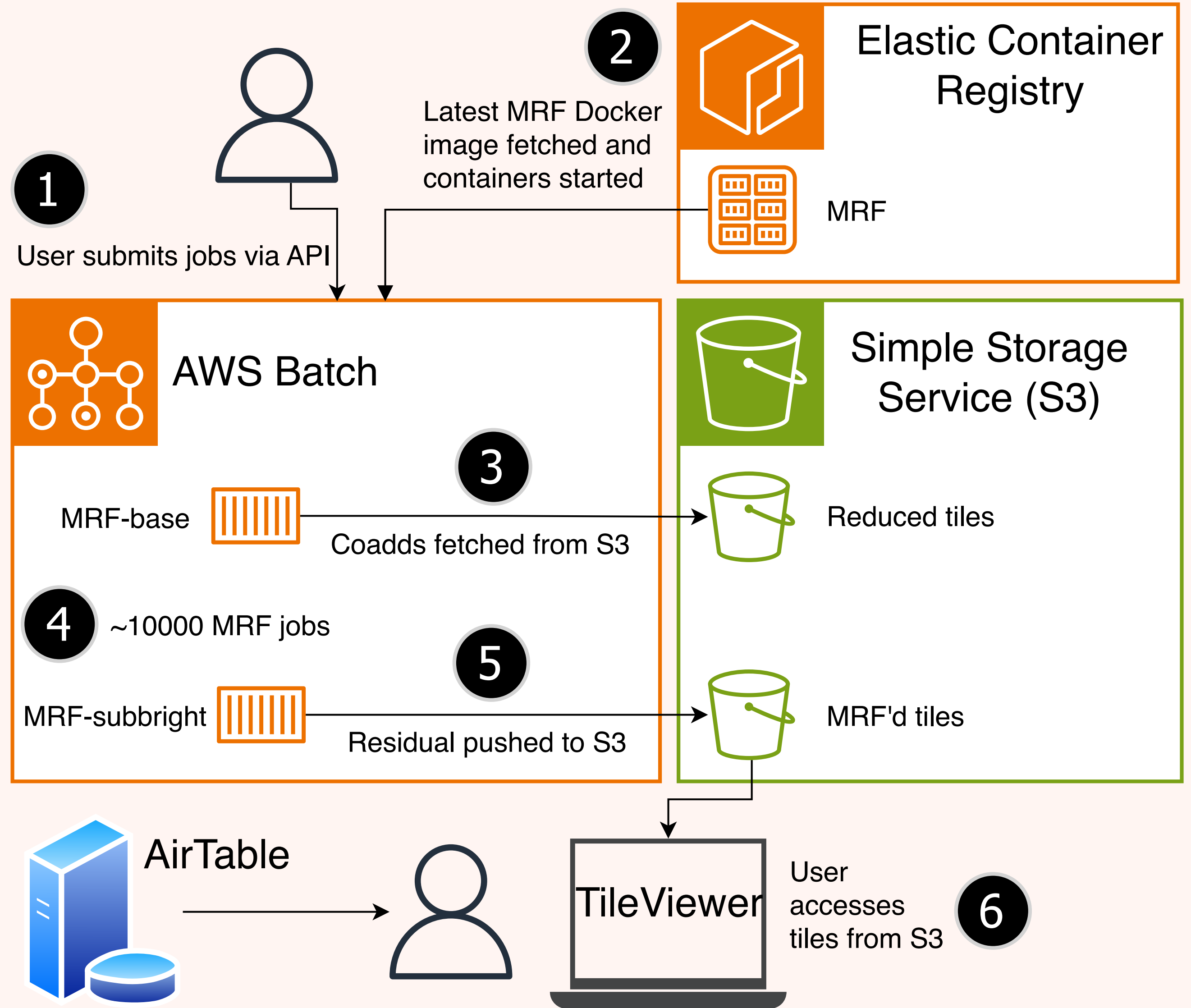


**After Multi-Resolution Filtering  
(MRF, van Dokkum+ 2020)**



# MRF ON AWS

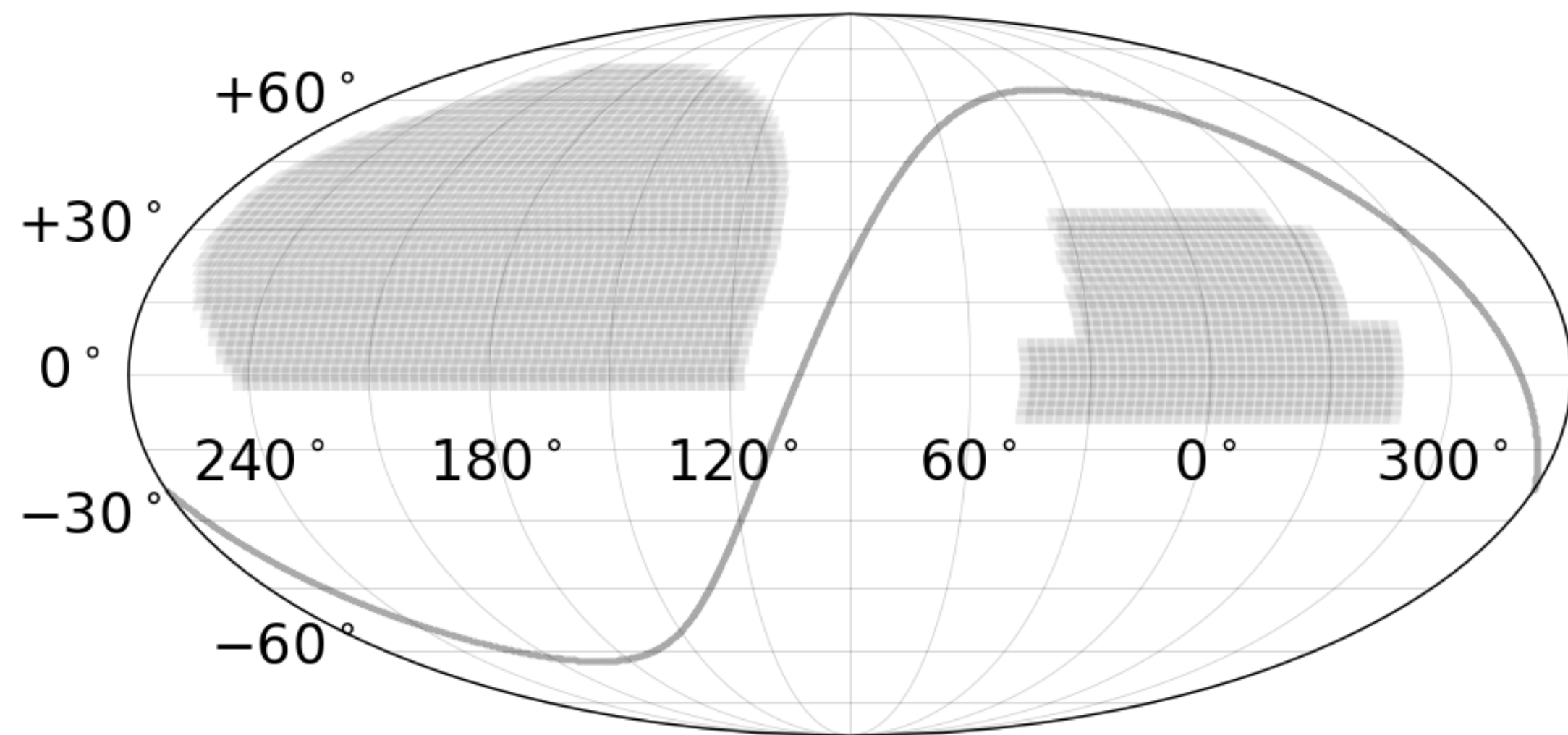
Funded by Yale-AWS grant



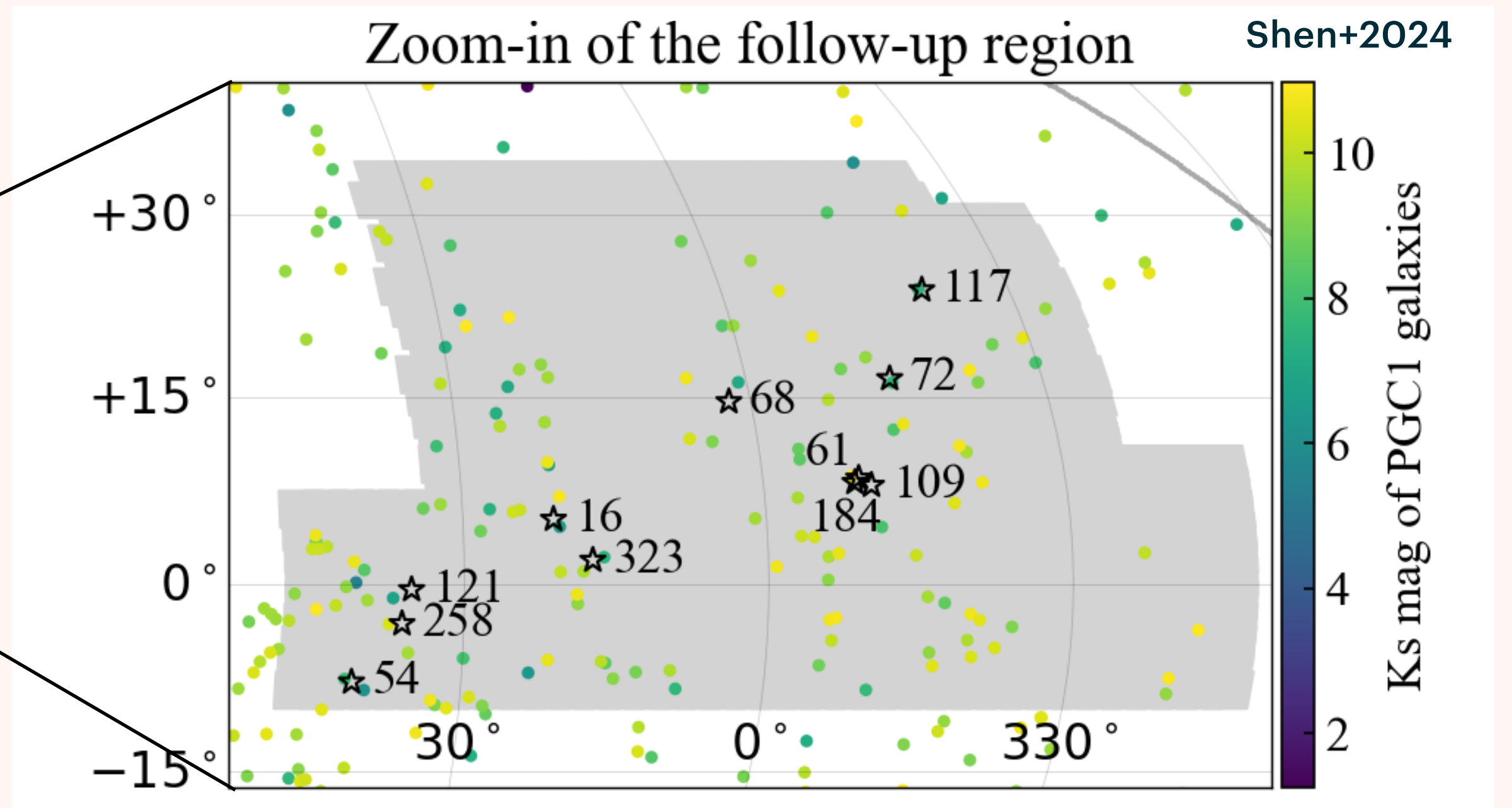
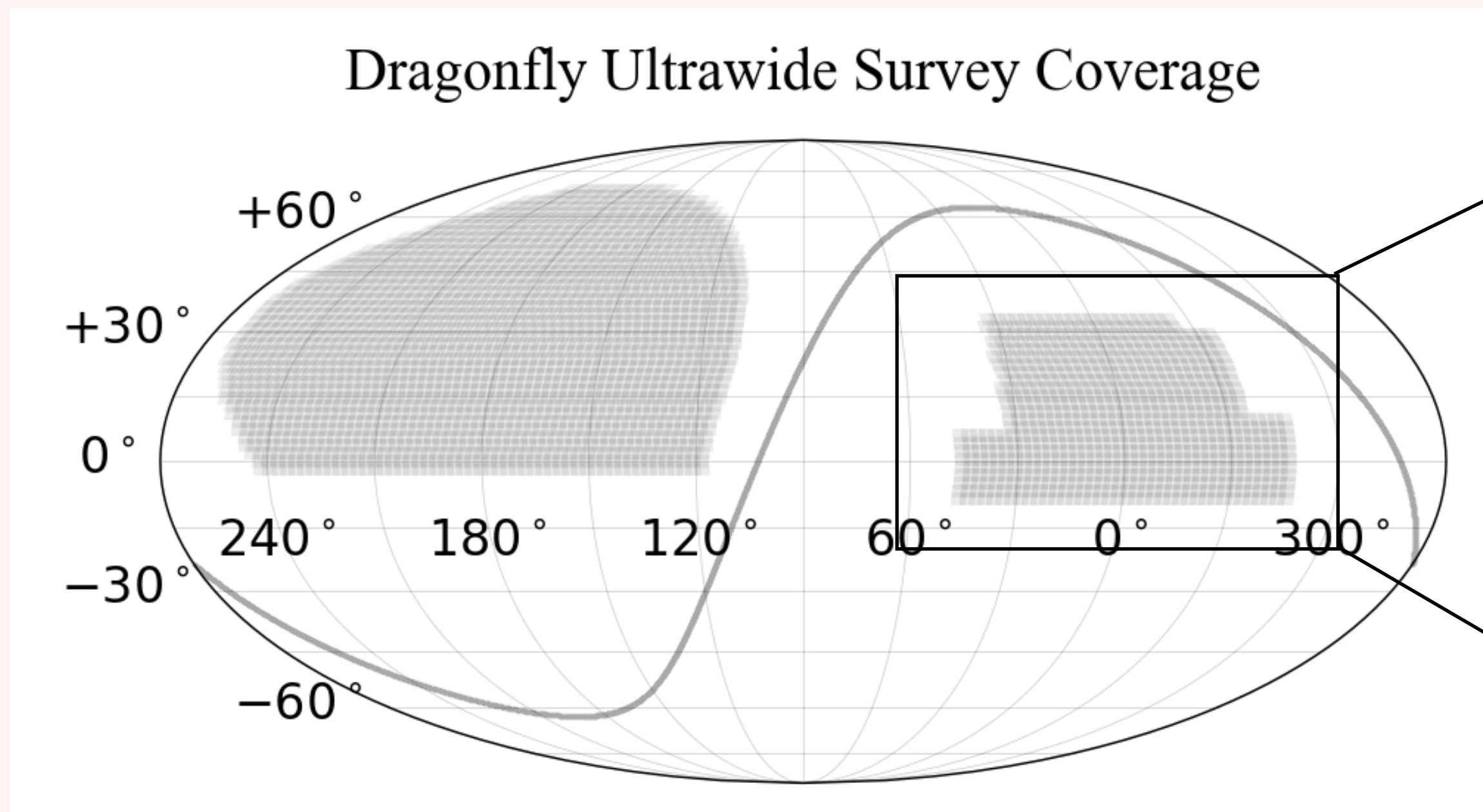
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# DRAGONFLY ULTRAWIDE SURVEY (DFUWS)

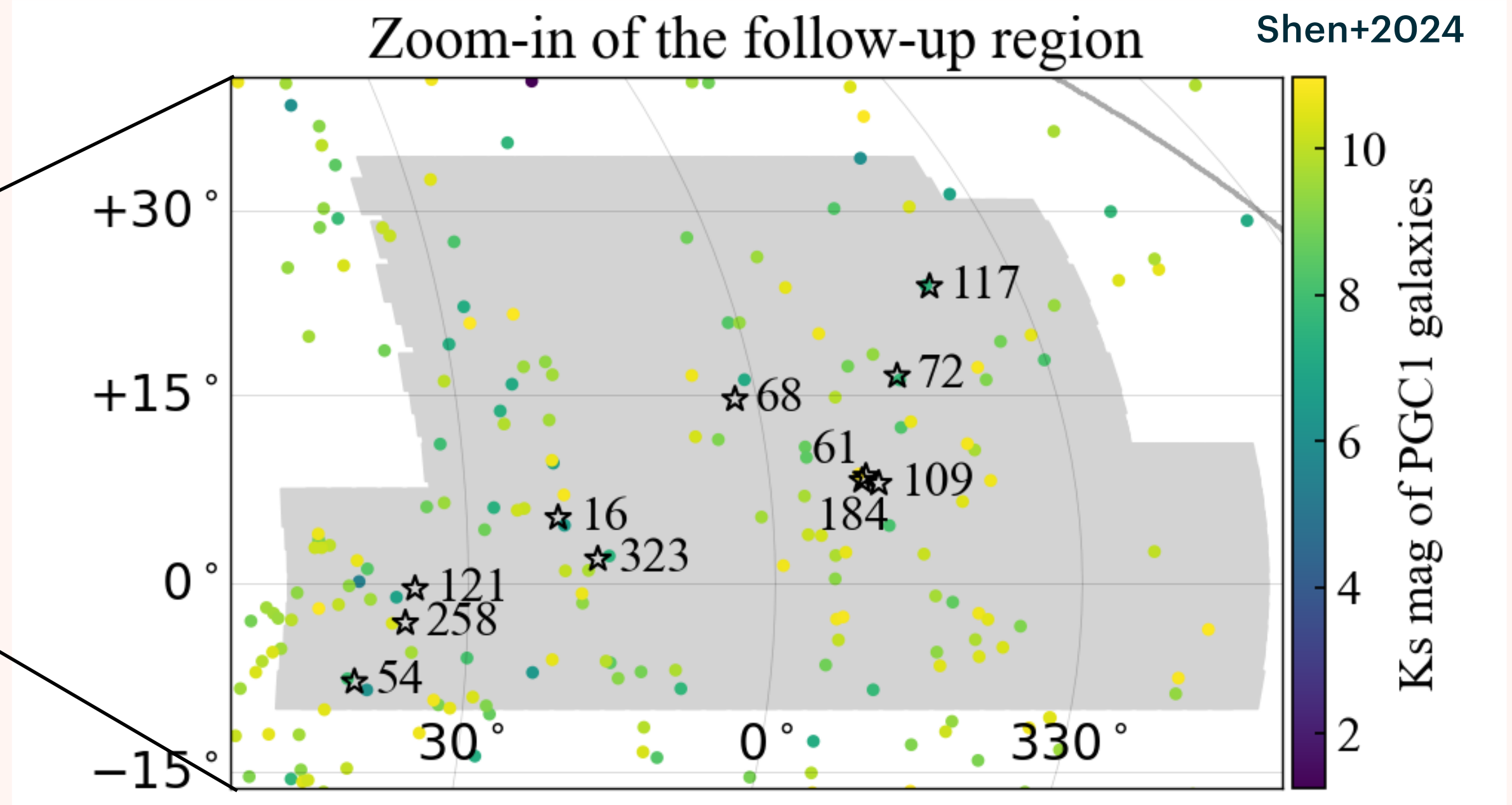
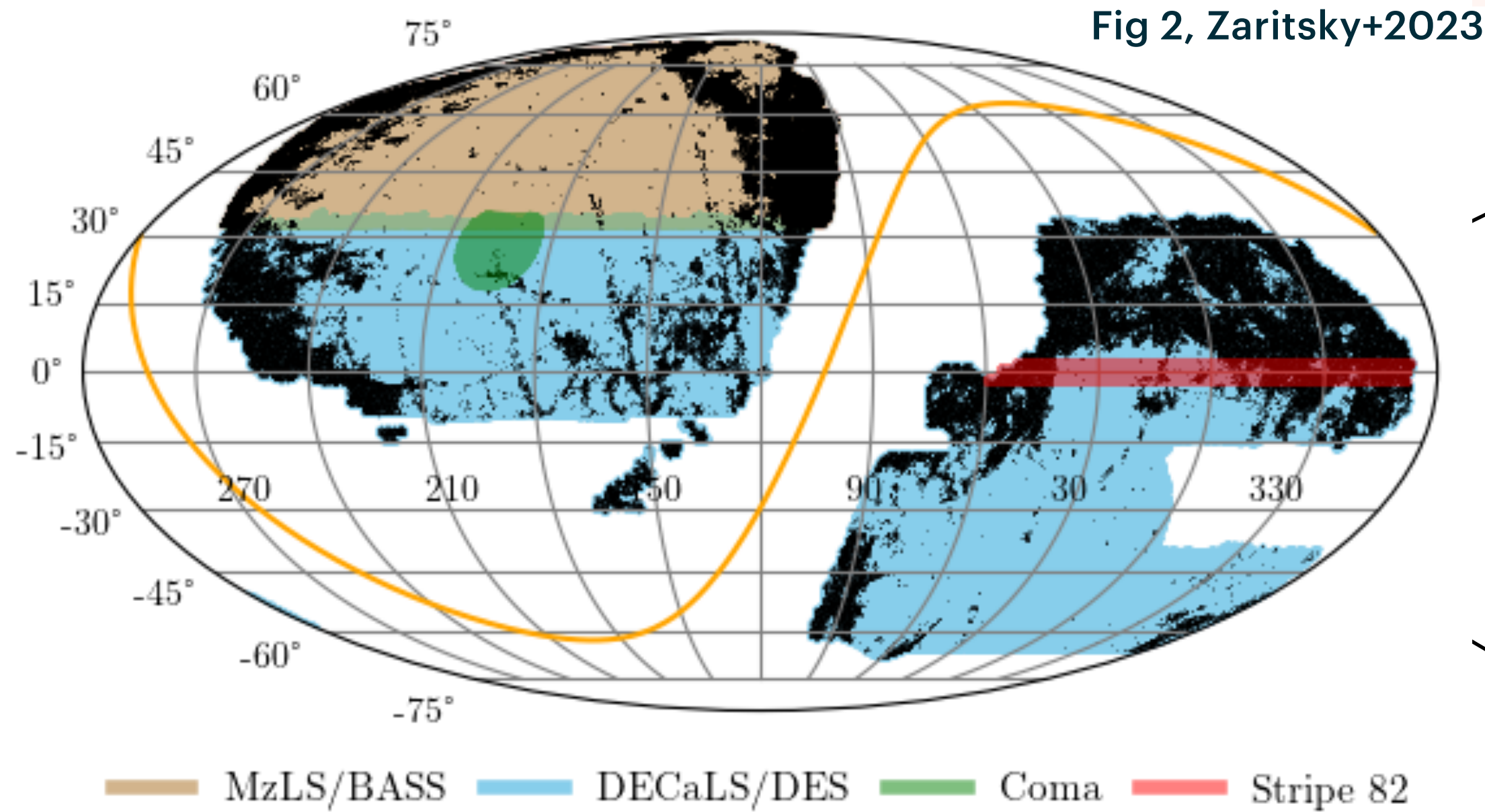
Dragonfly Ultrawide Survey Coverage



# DRAGONFLY ULTRAWIDE SURVEY (DFUWS)



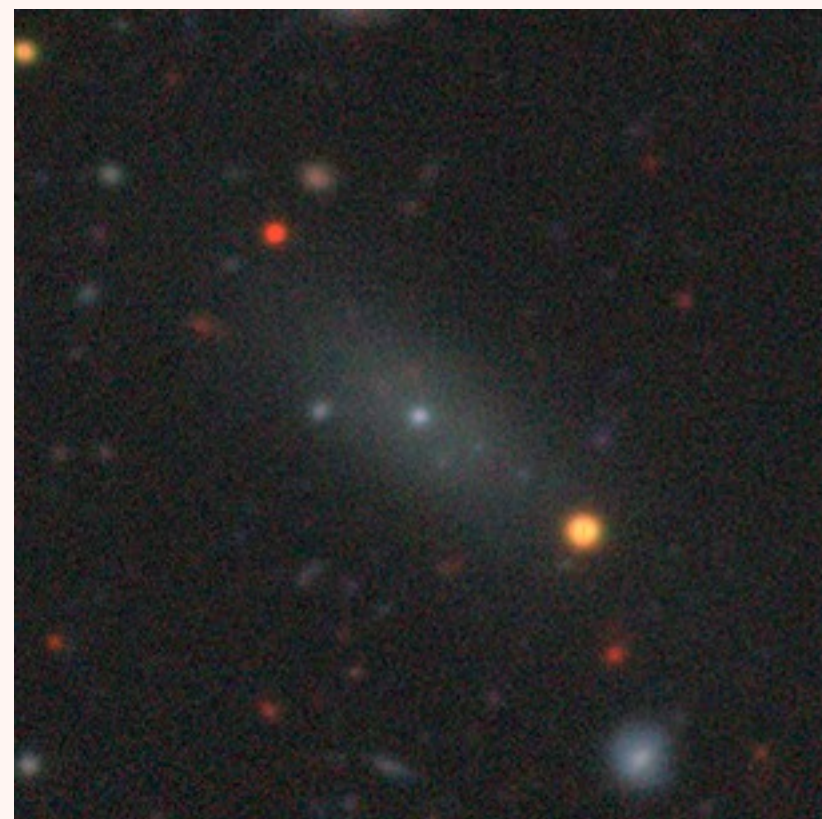
# DRAGONFLY ULTRAWIDE SURVEY (DFUWS)



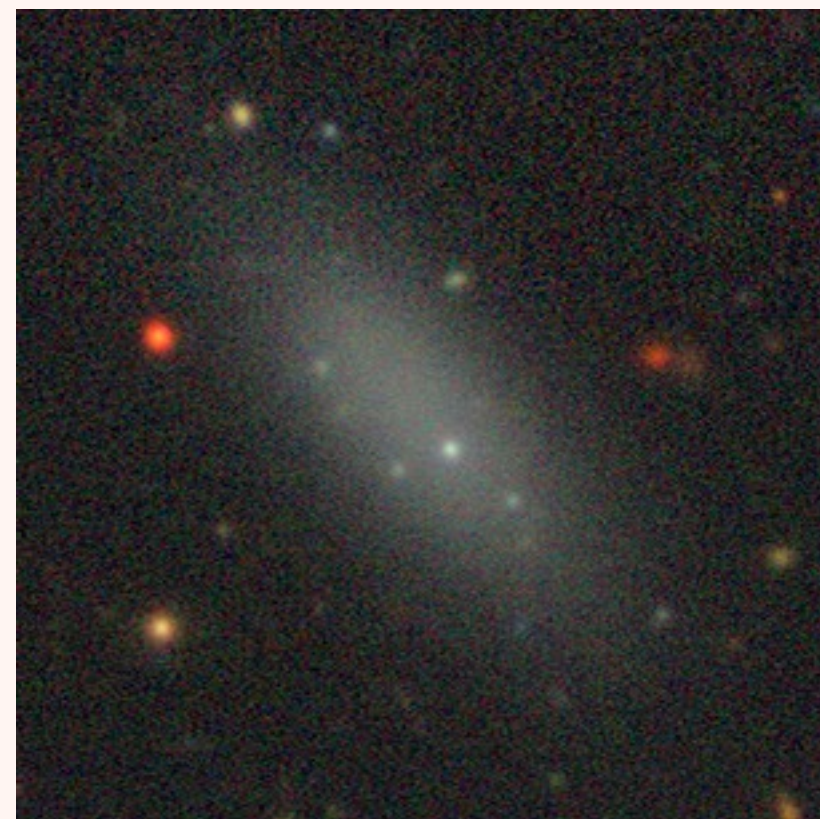
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# BIGGEST BLOBS IN DFUWS

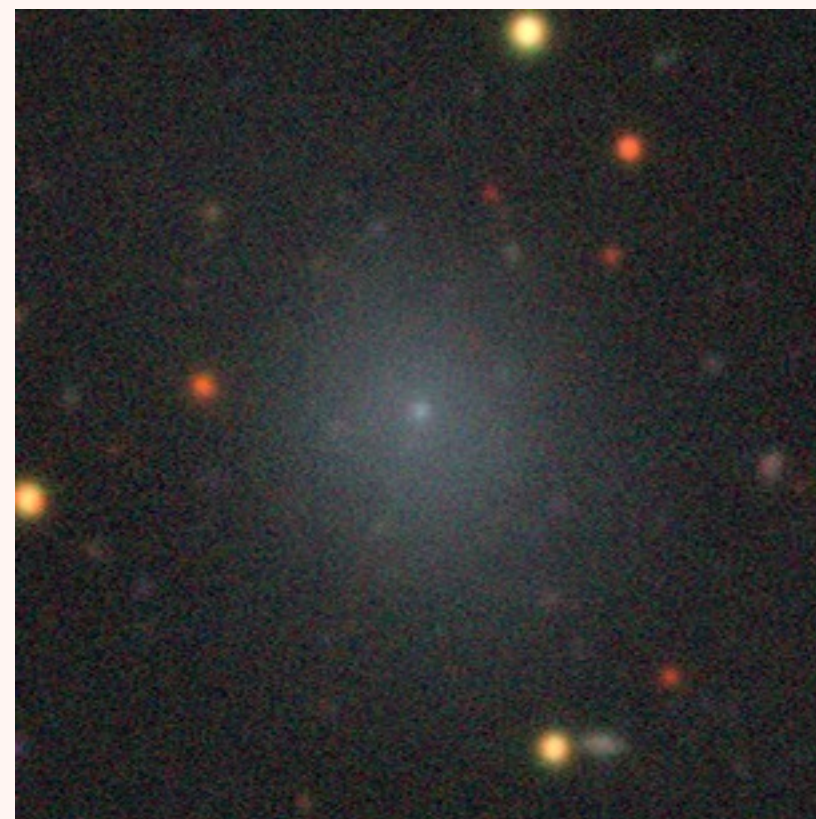
54



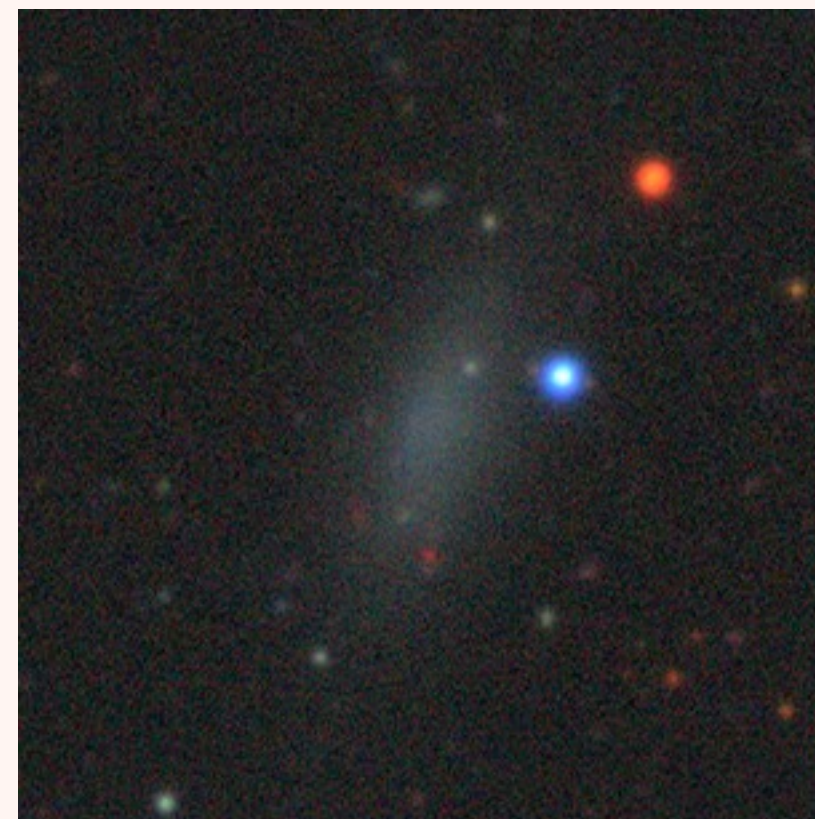
68



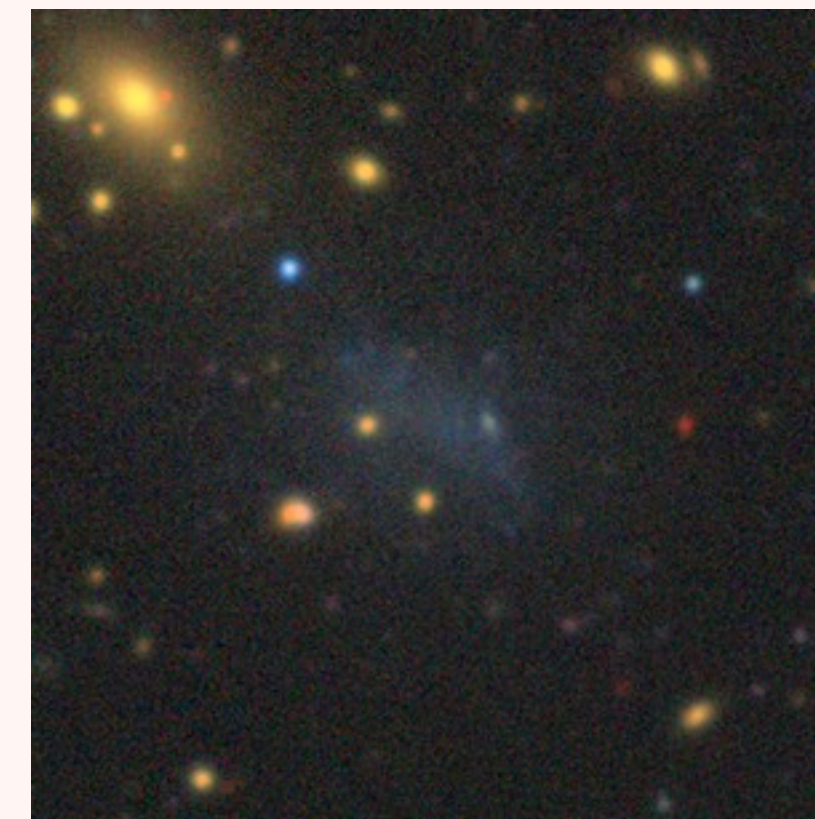
117



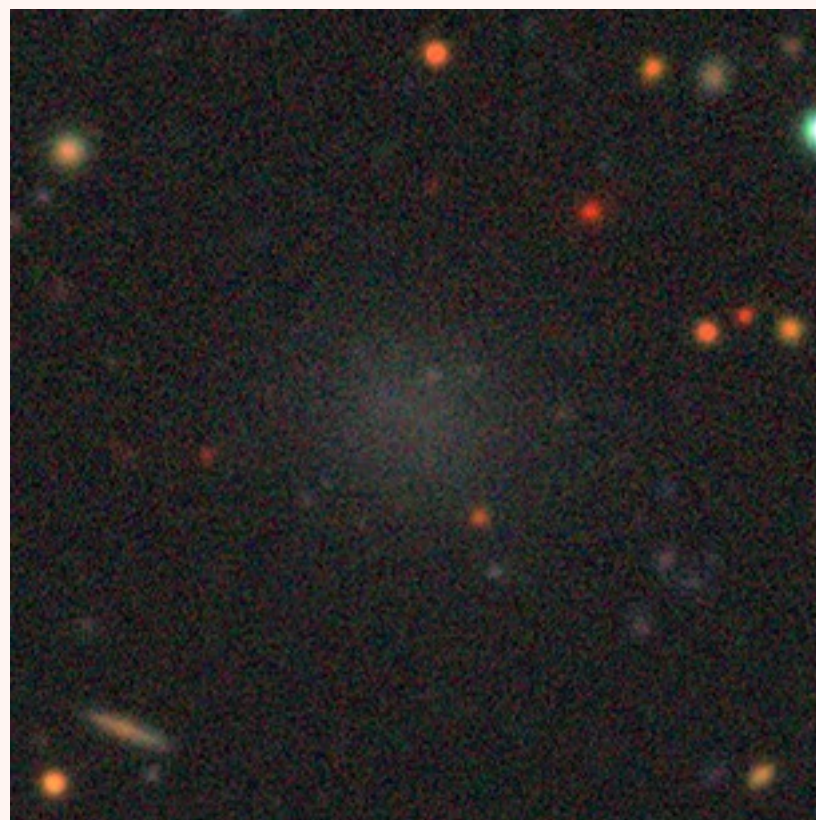
258



323



61



72



16



109



184



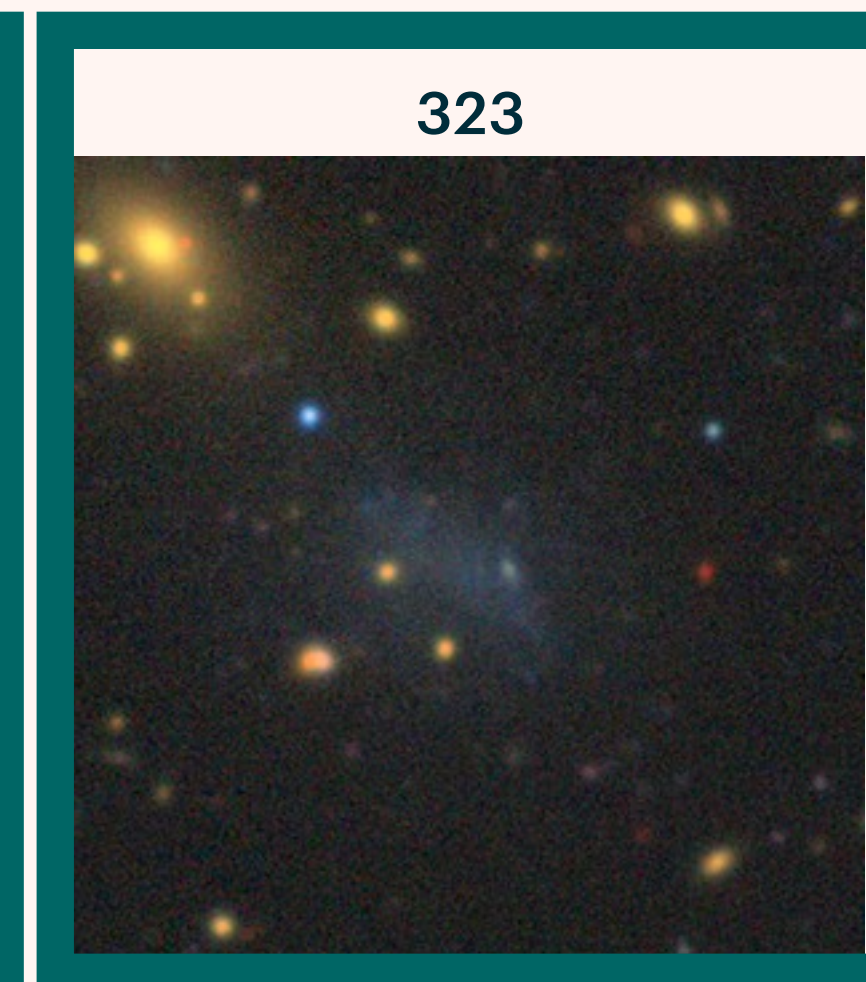
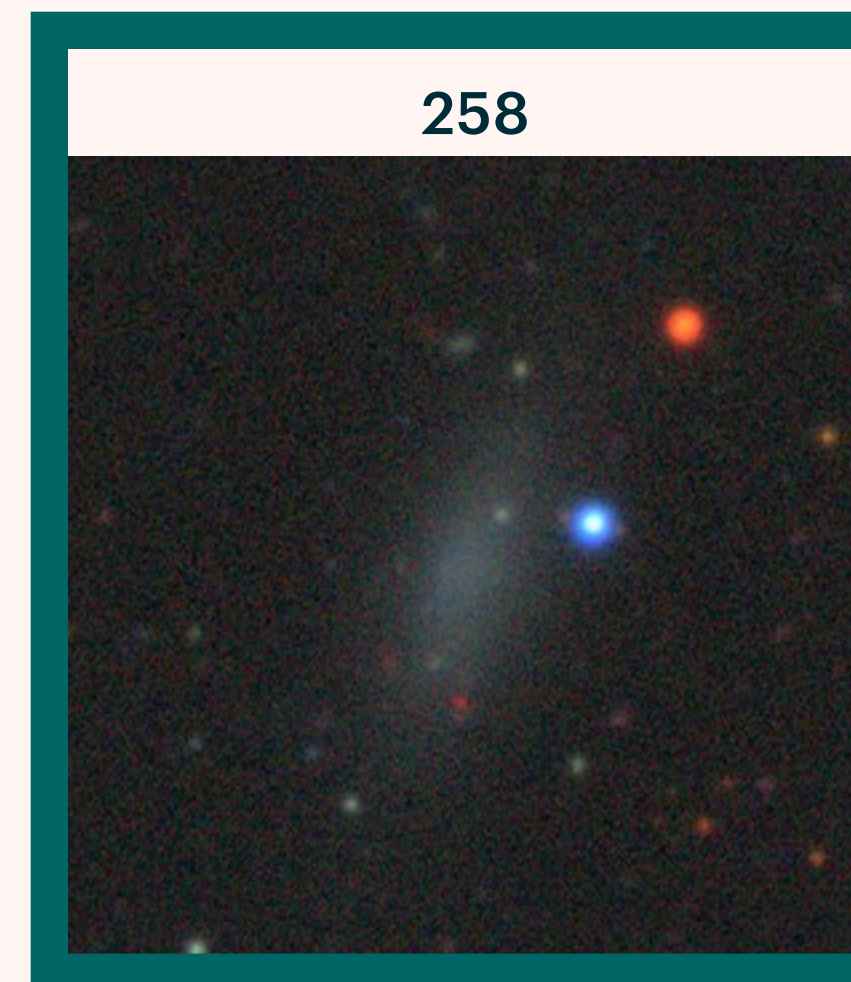
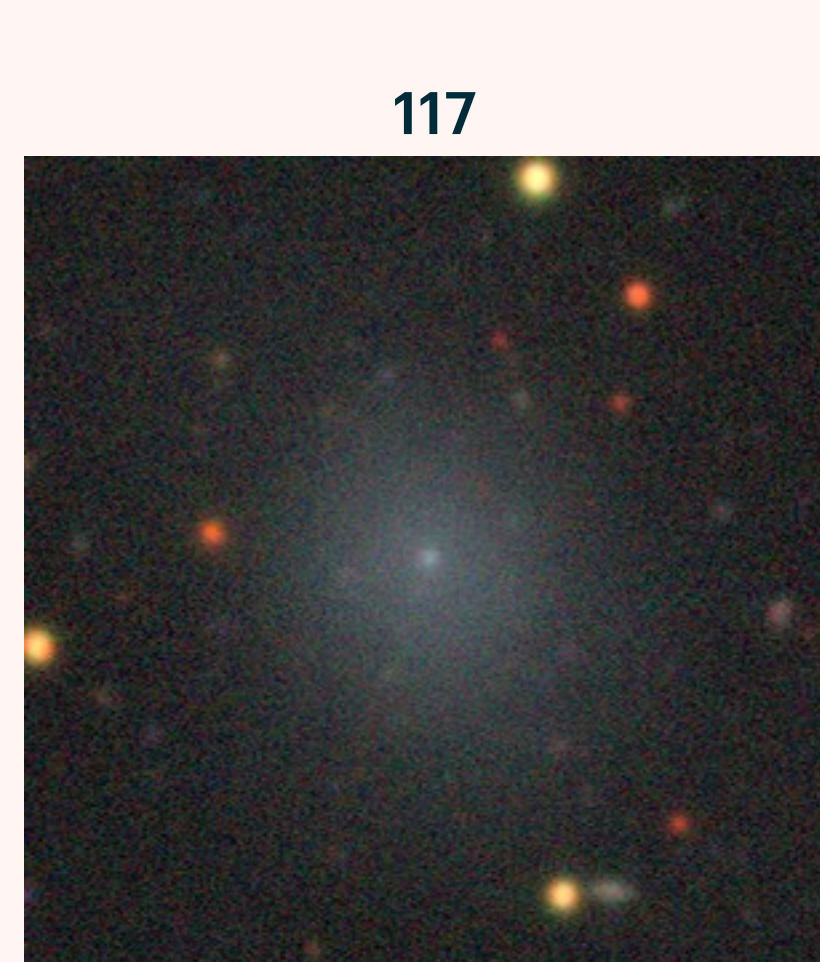
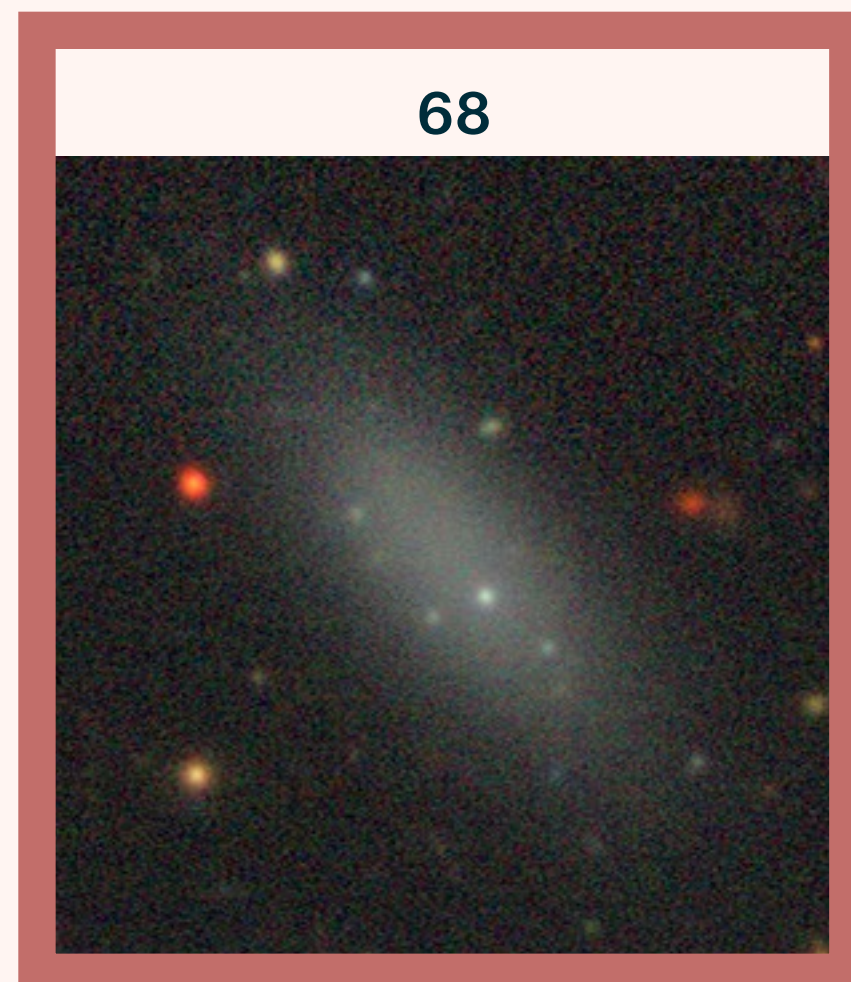
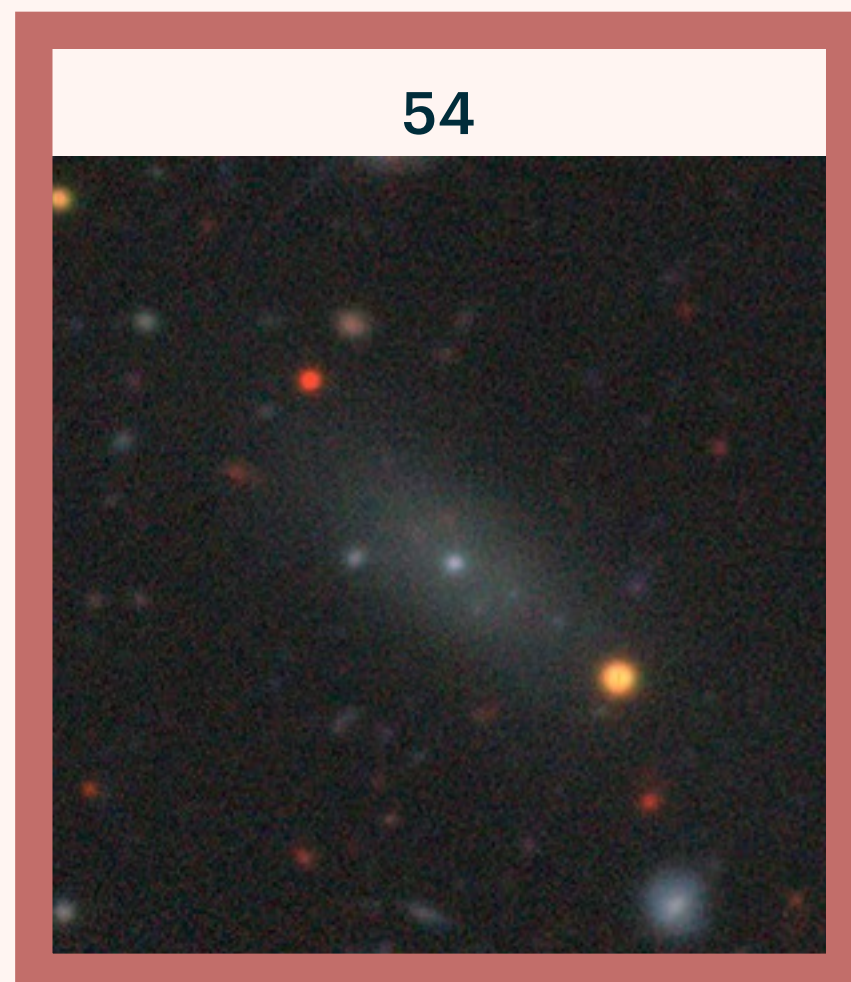
121



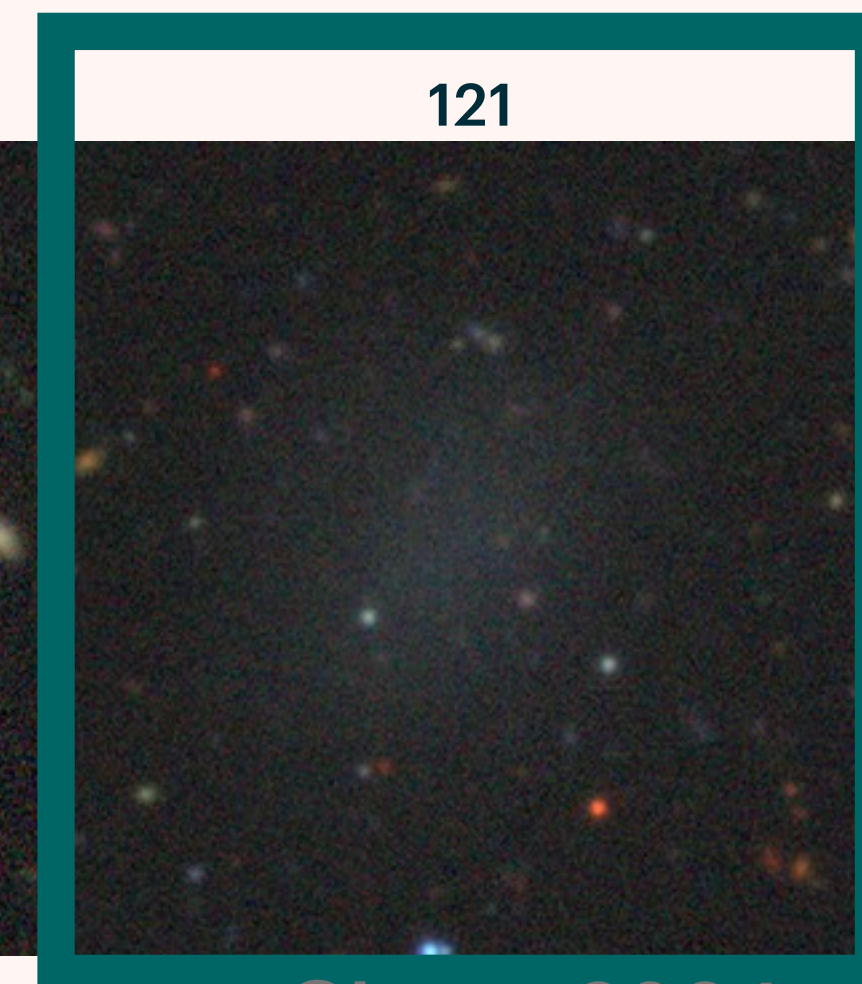
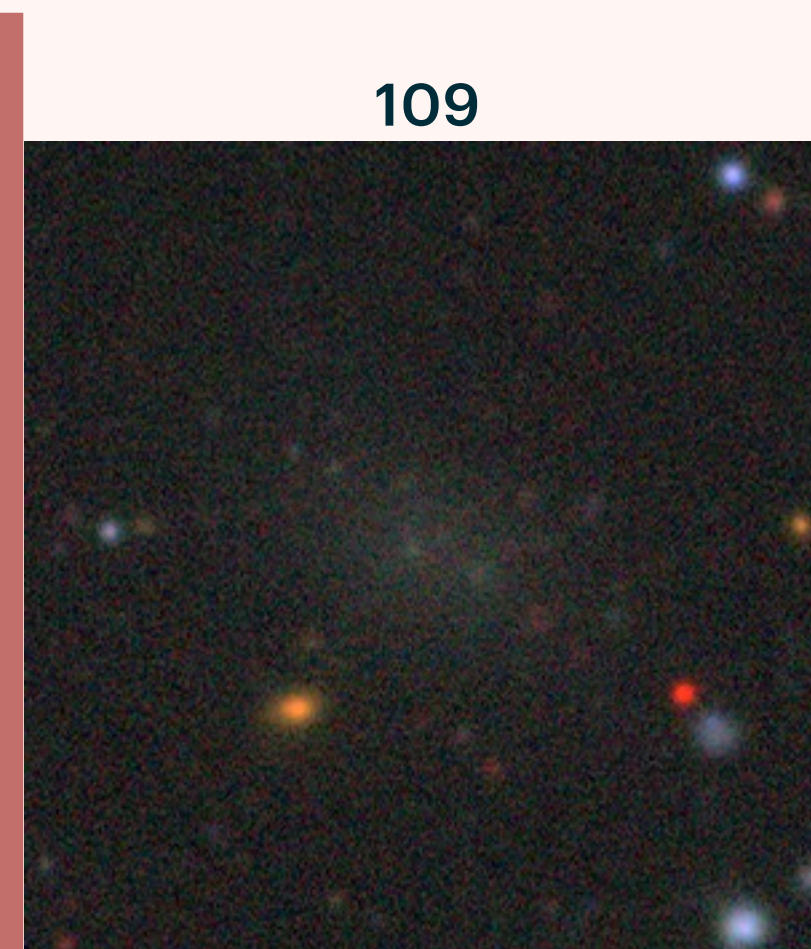
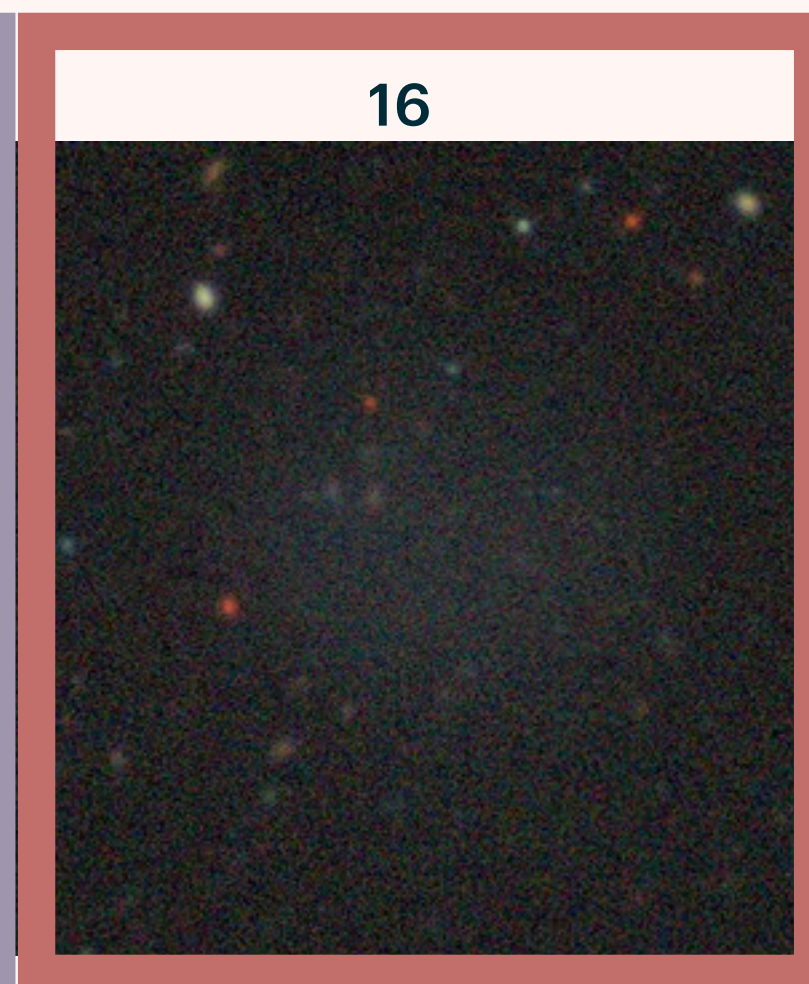
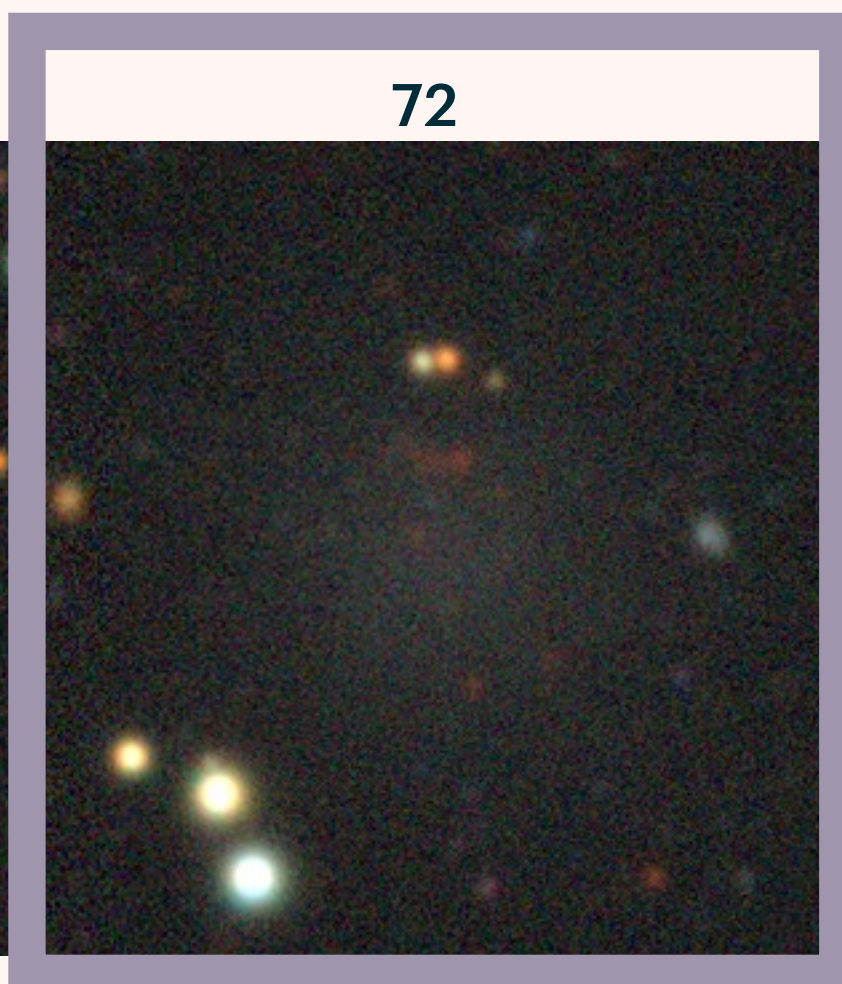
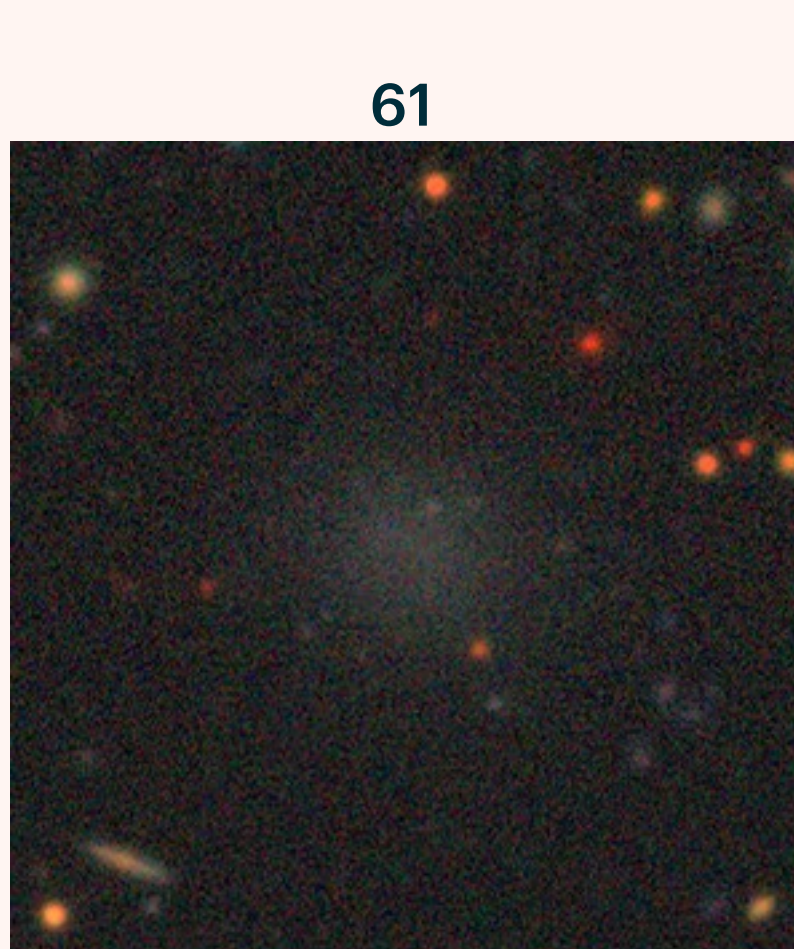
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**Paudel+2023**

**SMUDGes, Zaritsky+2023**



**MATLAS-2176**



Shen+2024

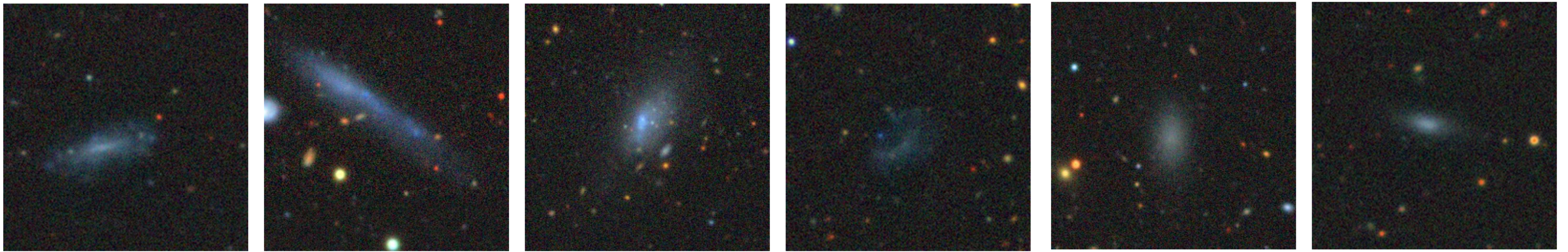
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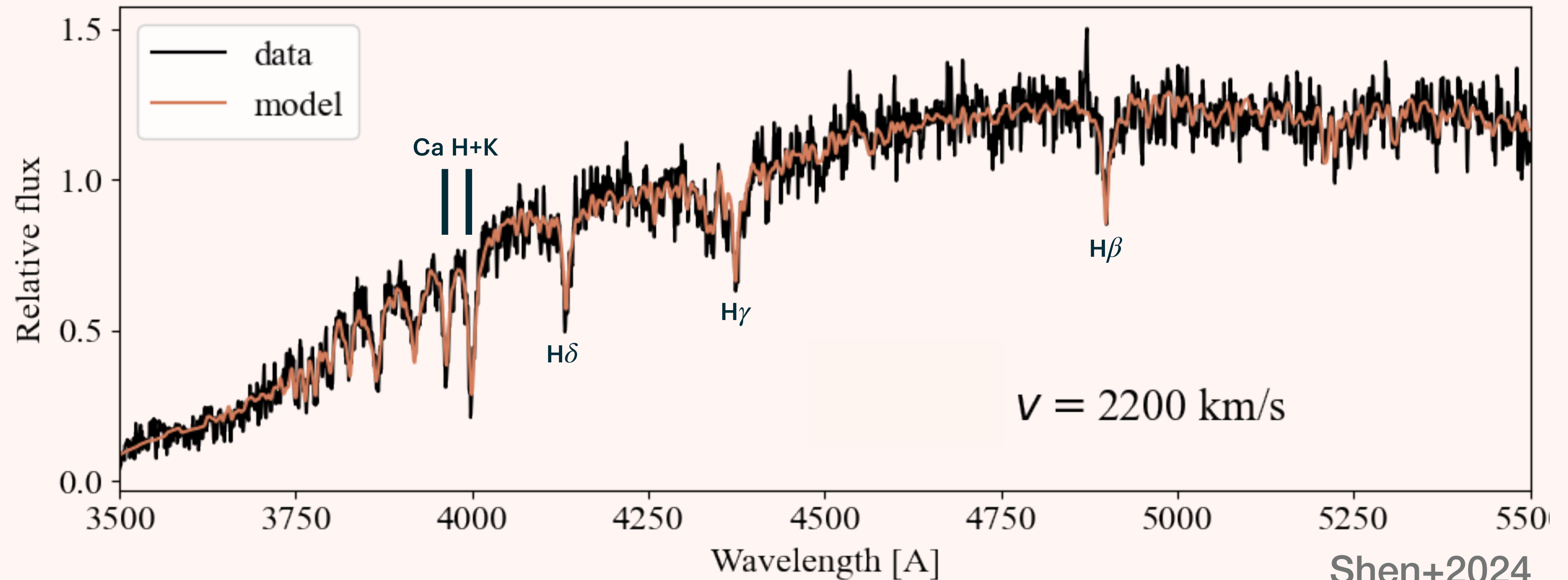
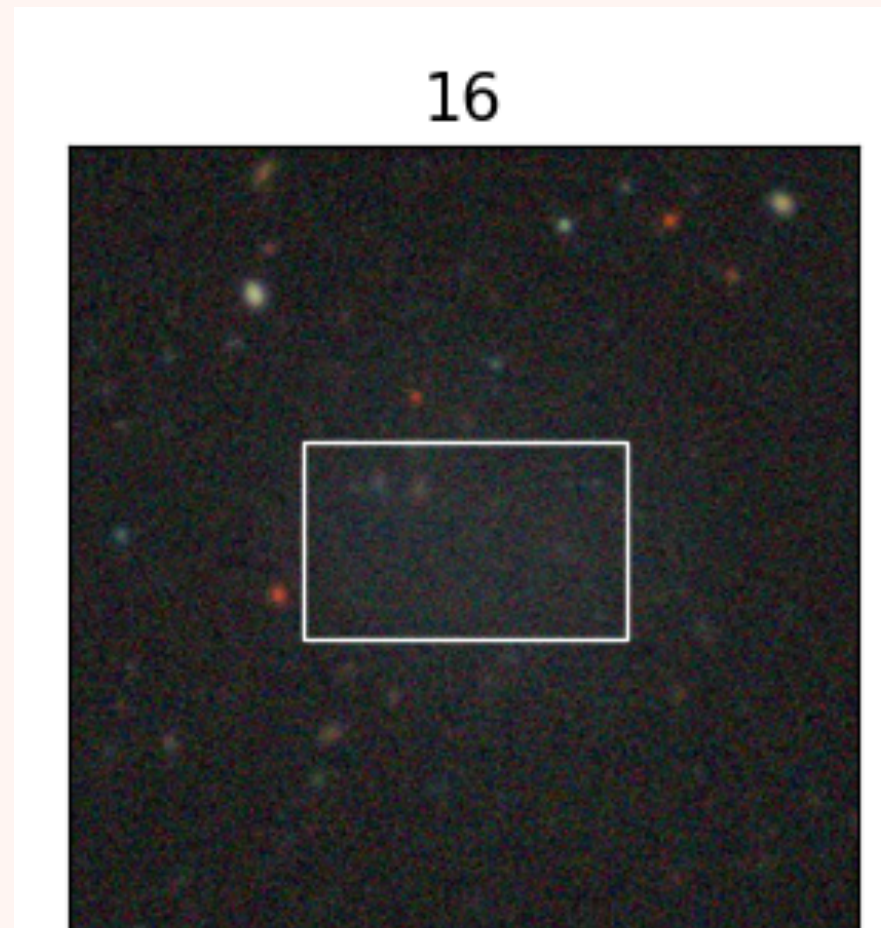
# SELECTION CRITERIA

- **Large apparent size:**  $R_{\text{eff}} > 15''$
- **Low surface brightness:** 8 have  $\mu_0(g) > 24 \text{ mag/arcsec}^2$ , 3 are between 23 – 24
- **No spirals, no clumps:** prefer quenched galaxies
- **Examples of galaxies that did not meet these criteria:**

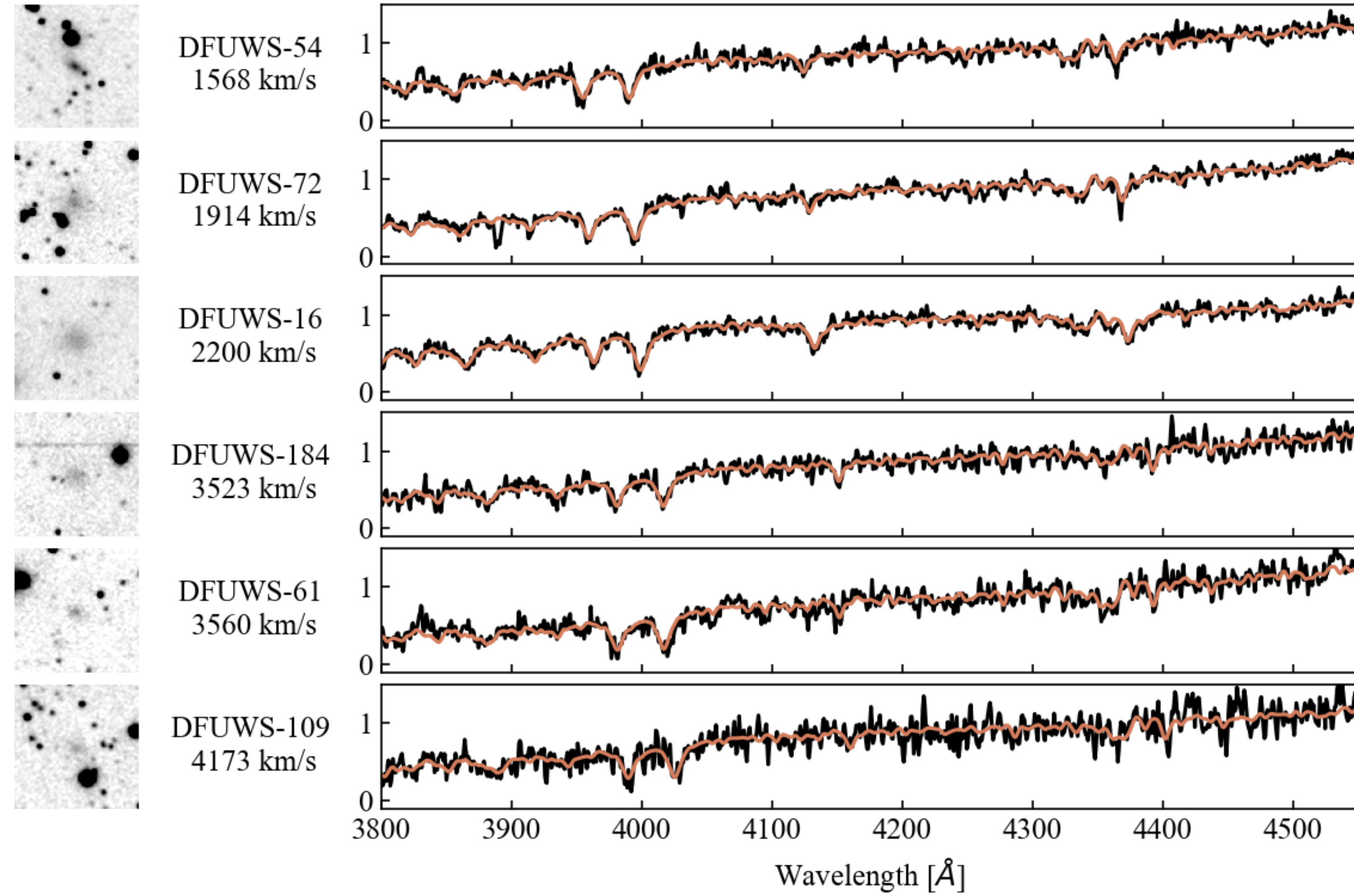
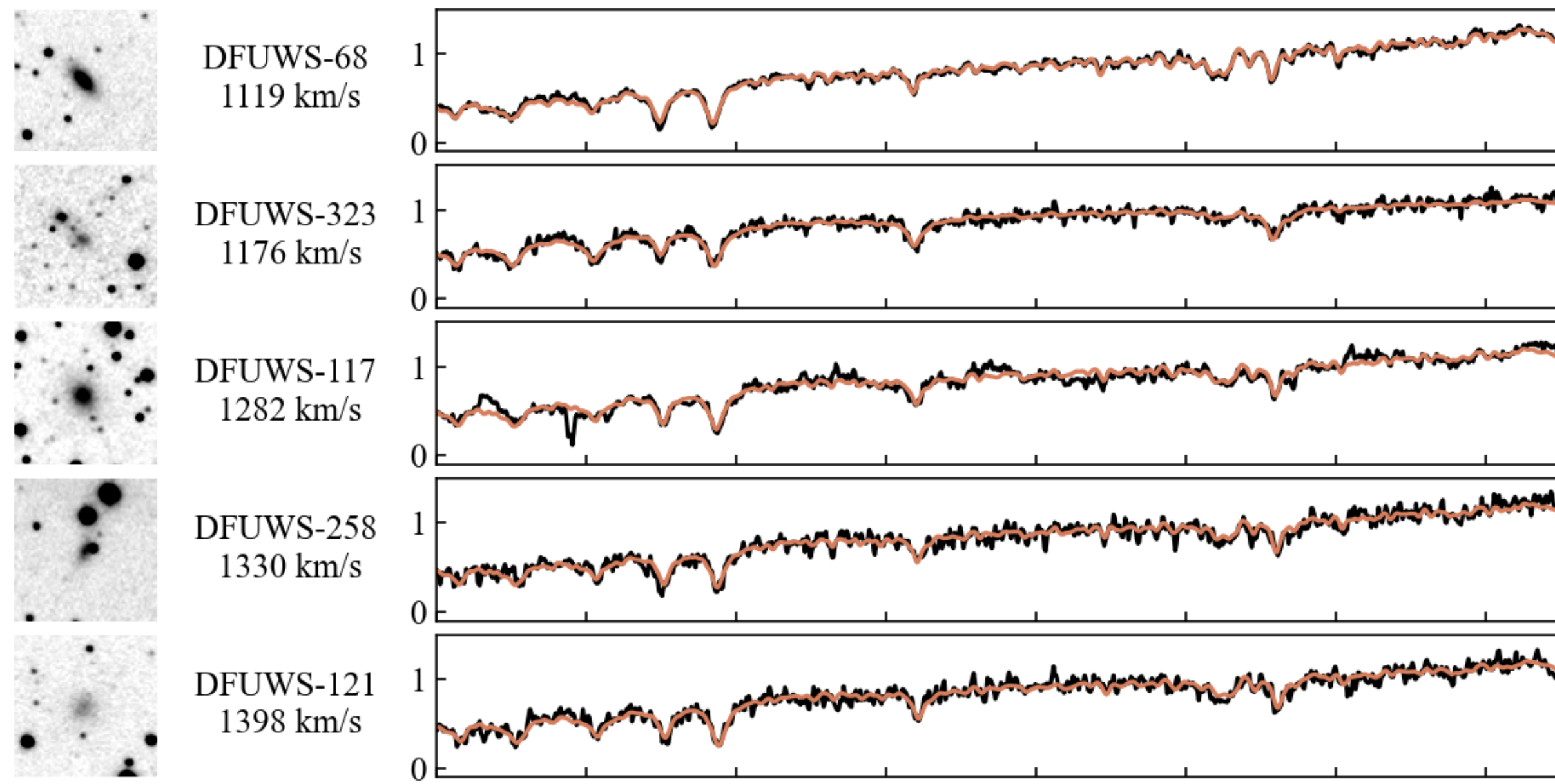


# KCWI FOLLOW-UP

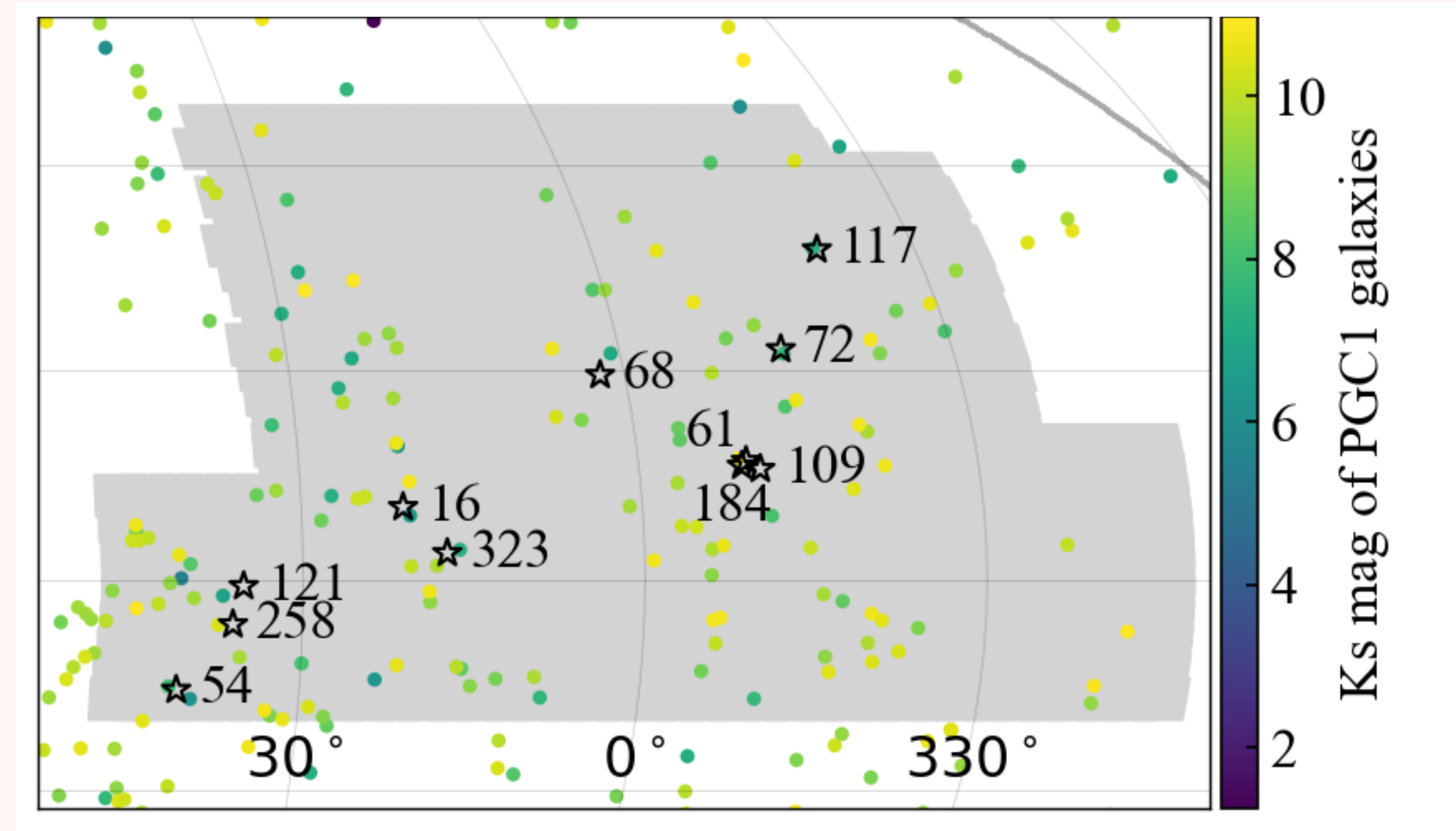
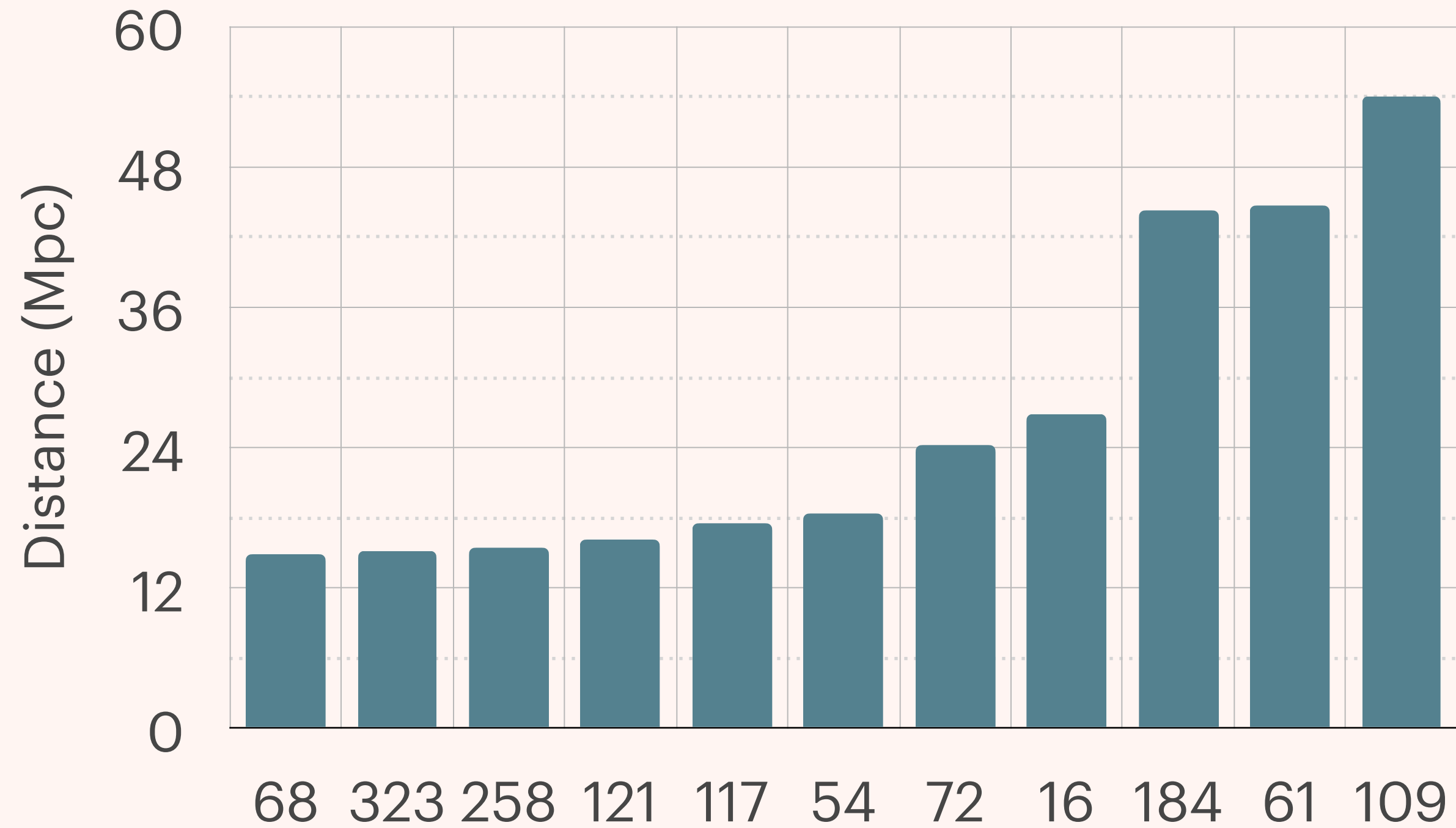
- Use KCWI large slicer (33" x 20") as light bucket → average over pixels in data cube
- Systematics & sky subtraction → 40 min on, 40 min off



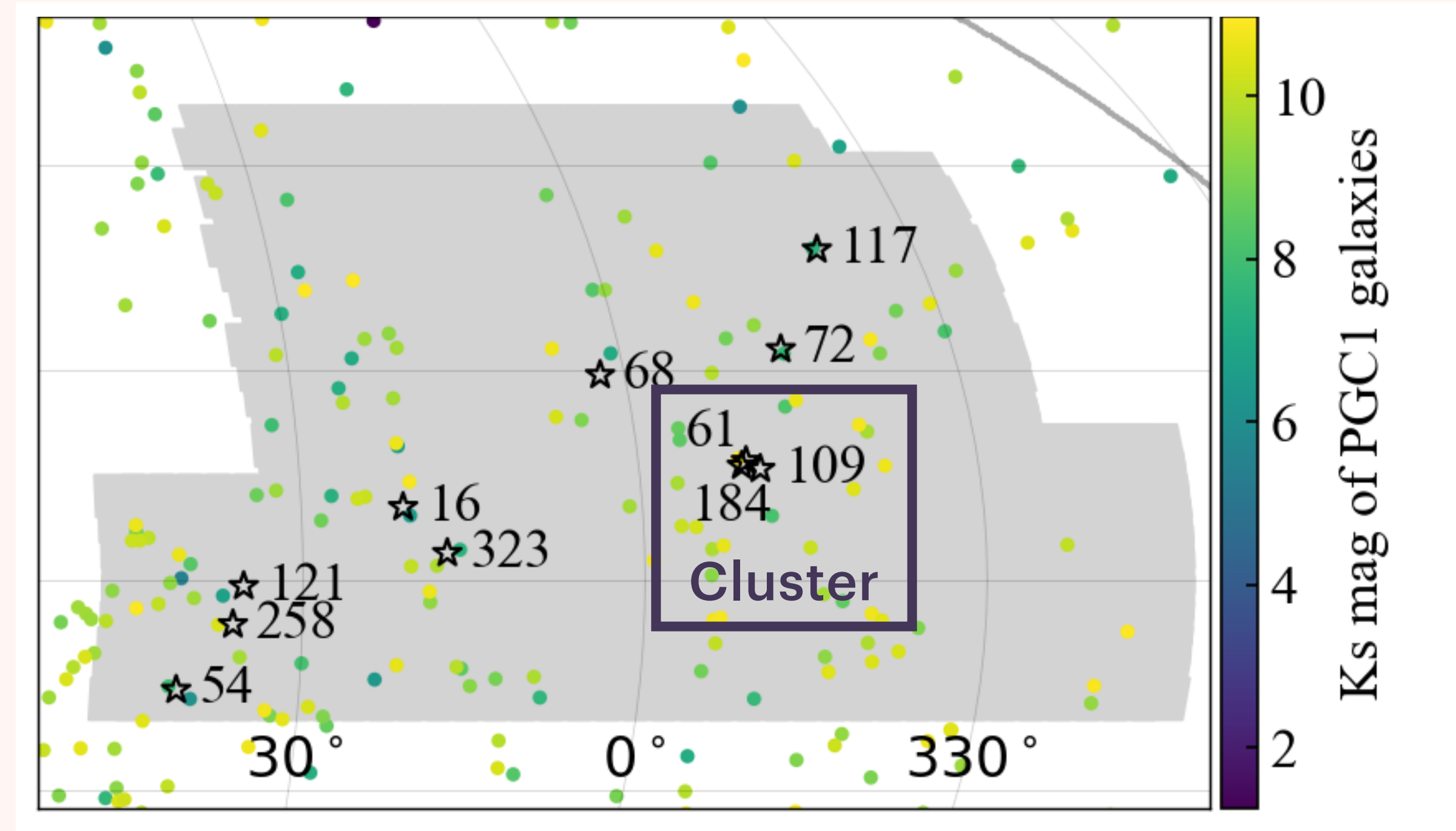
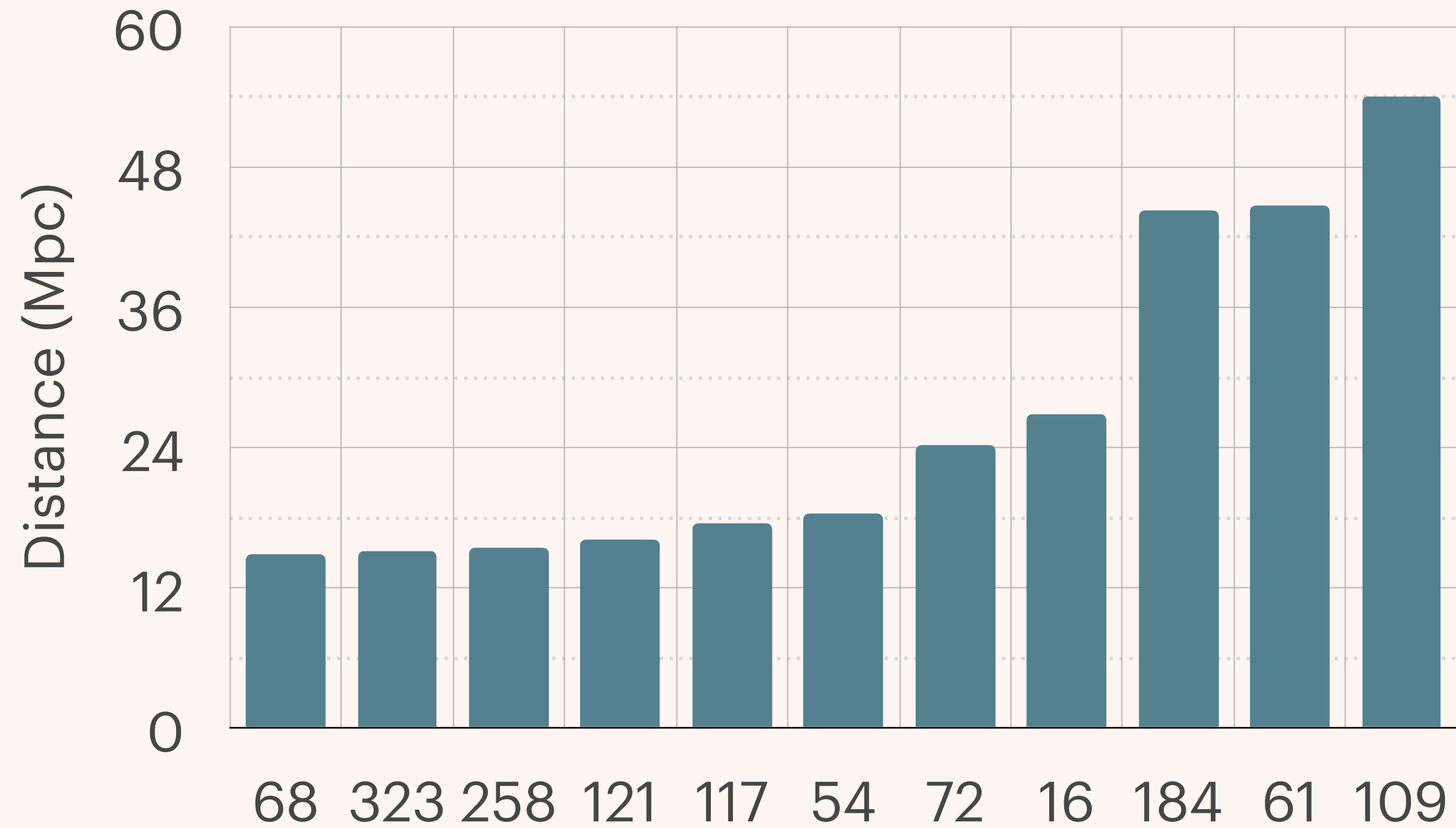
# KCWI FOLLOW-UP



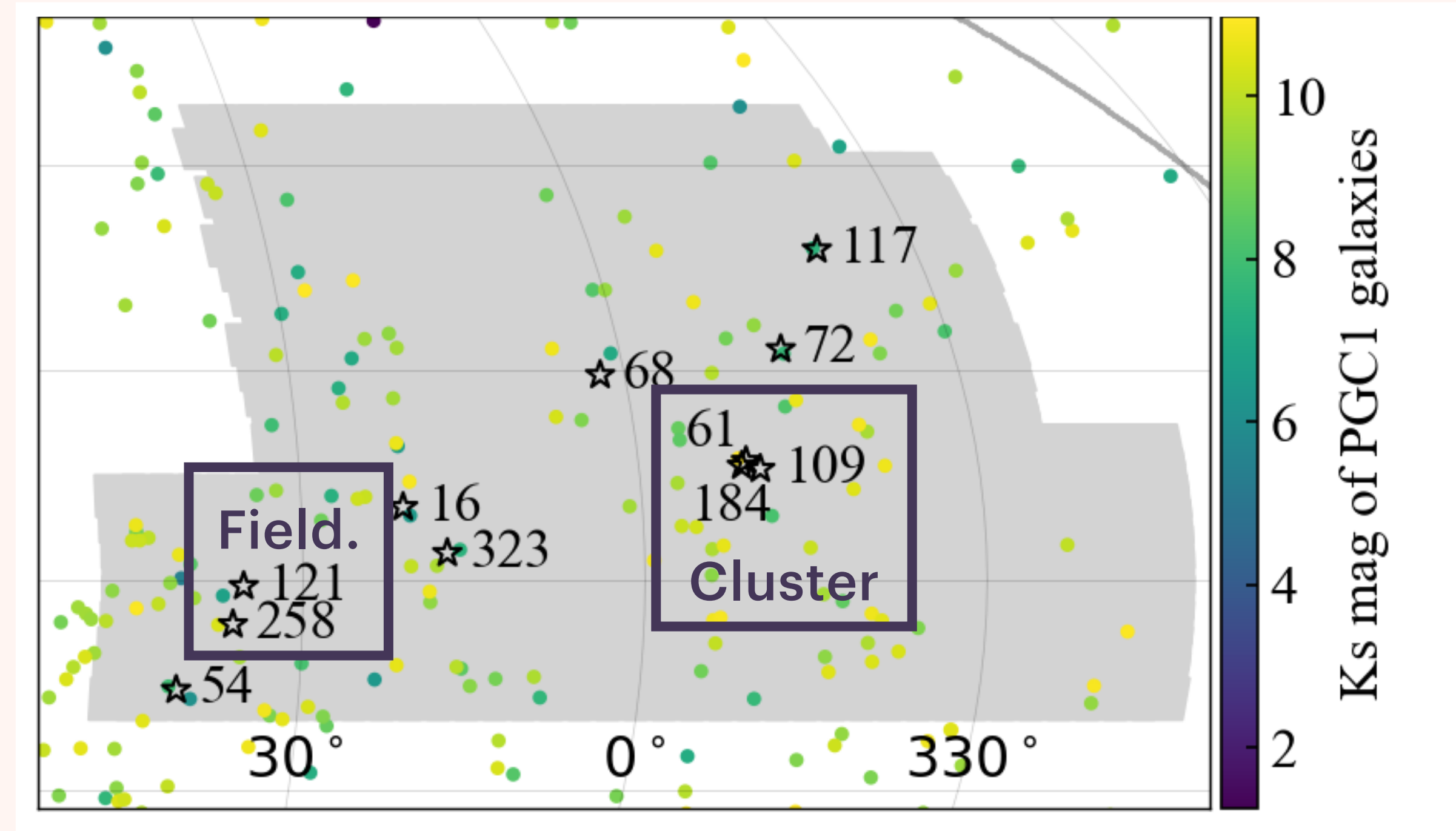
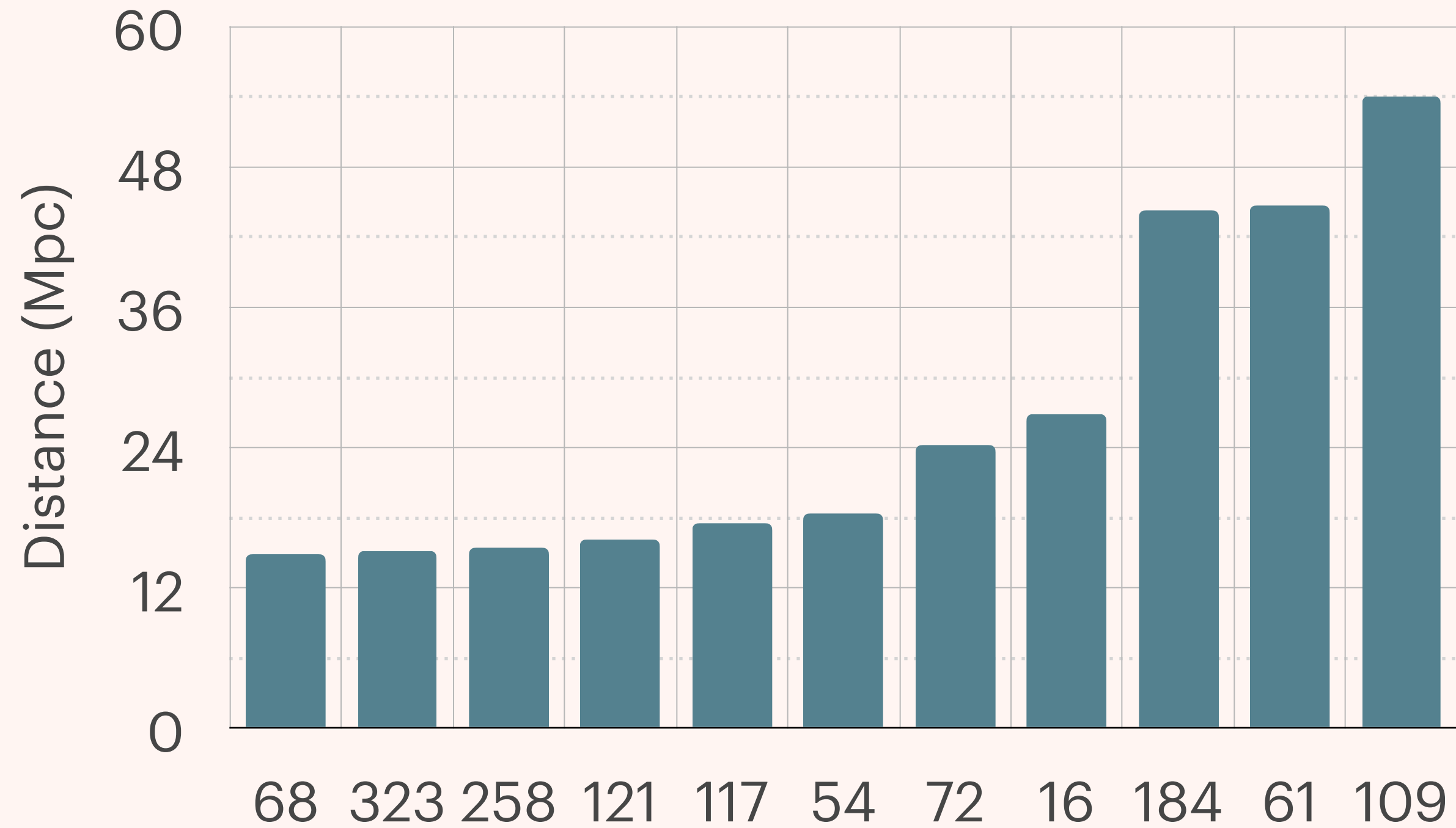
# MOST BLOBS ARE WITHIN 25 MPC



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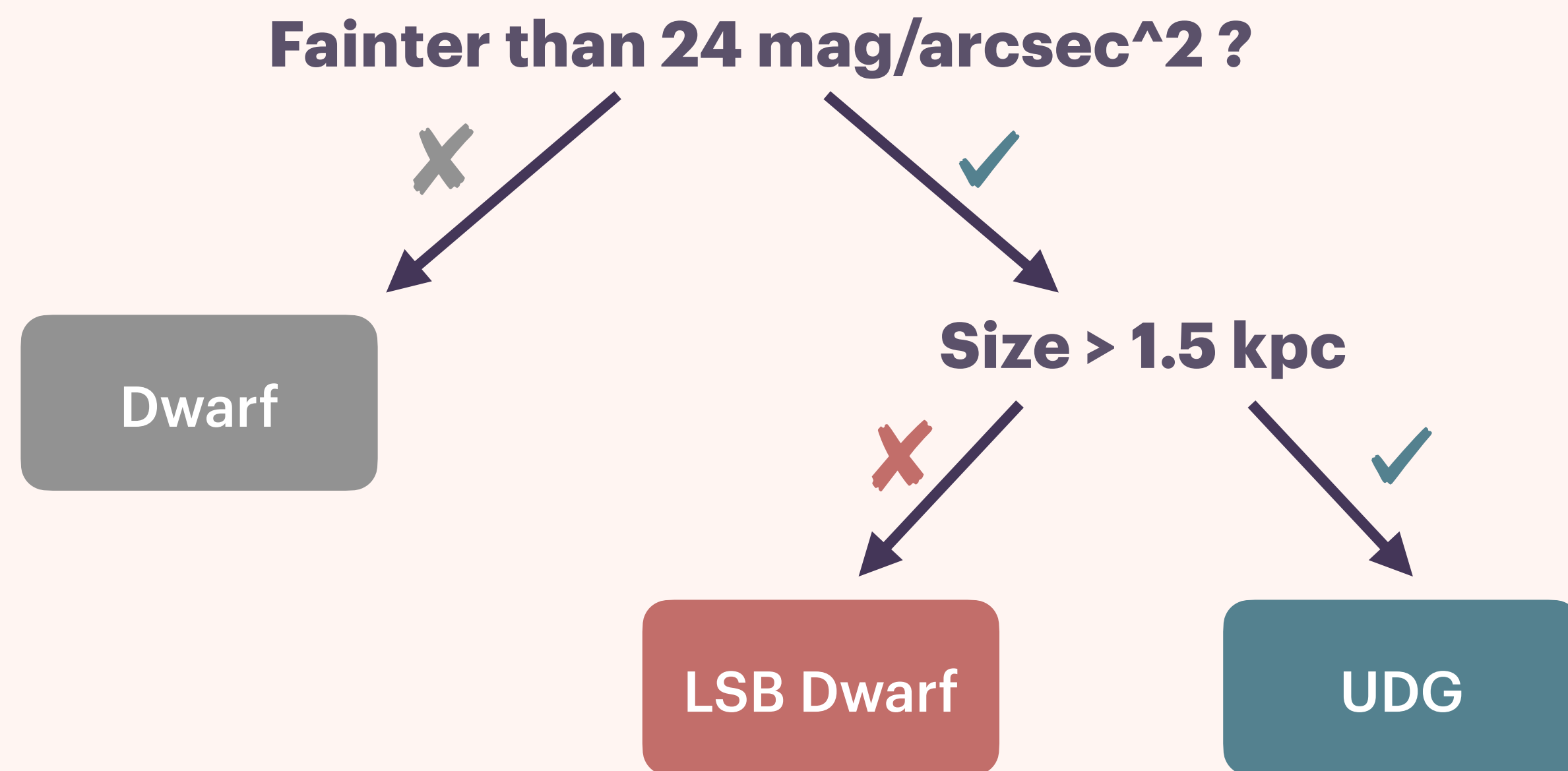
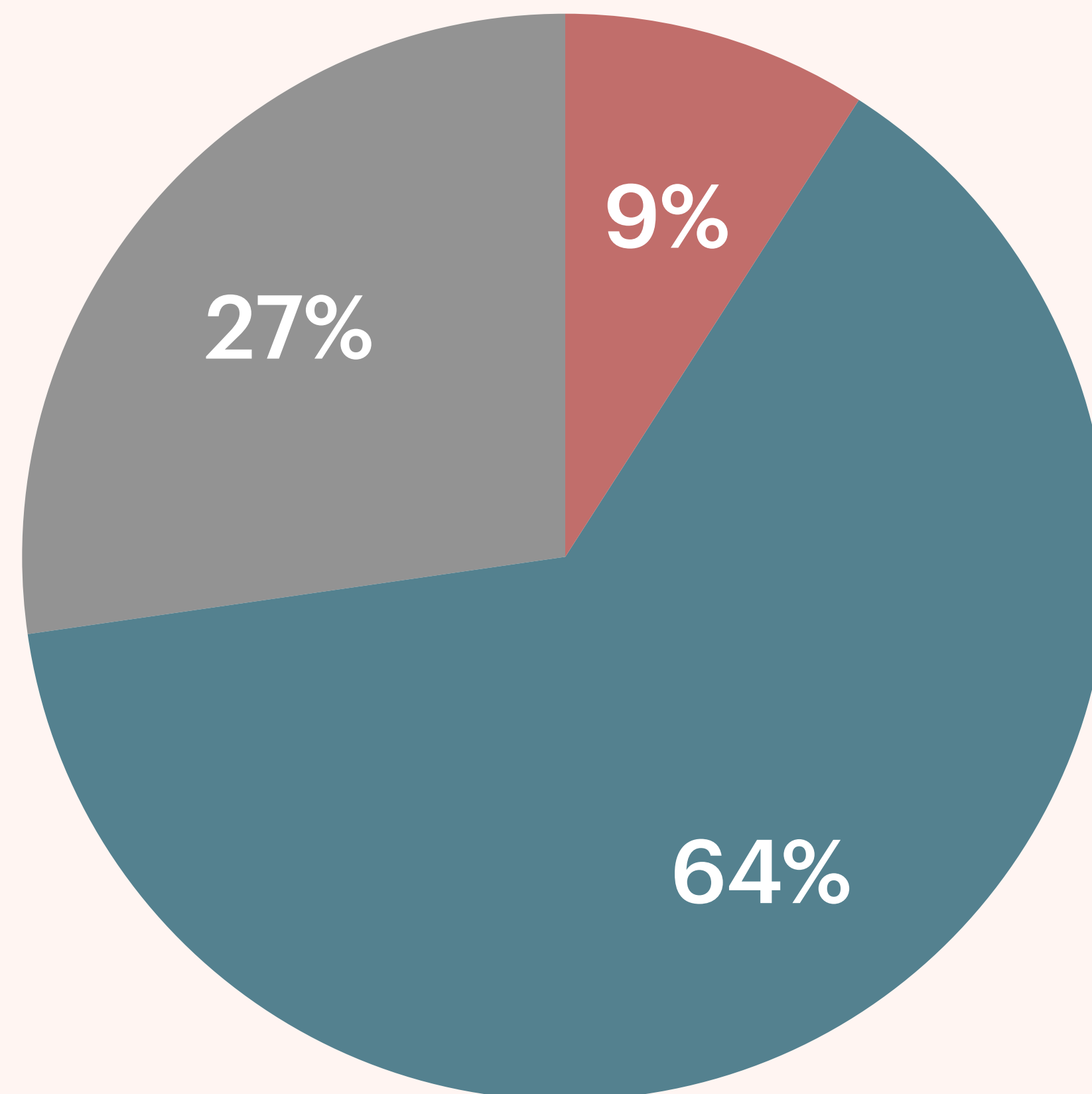
# MOST BLOBS ARE WITHIN 25 MPC



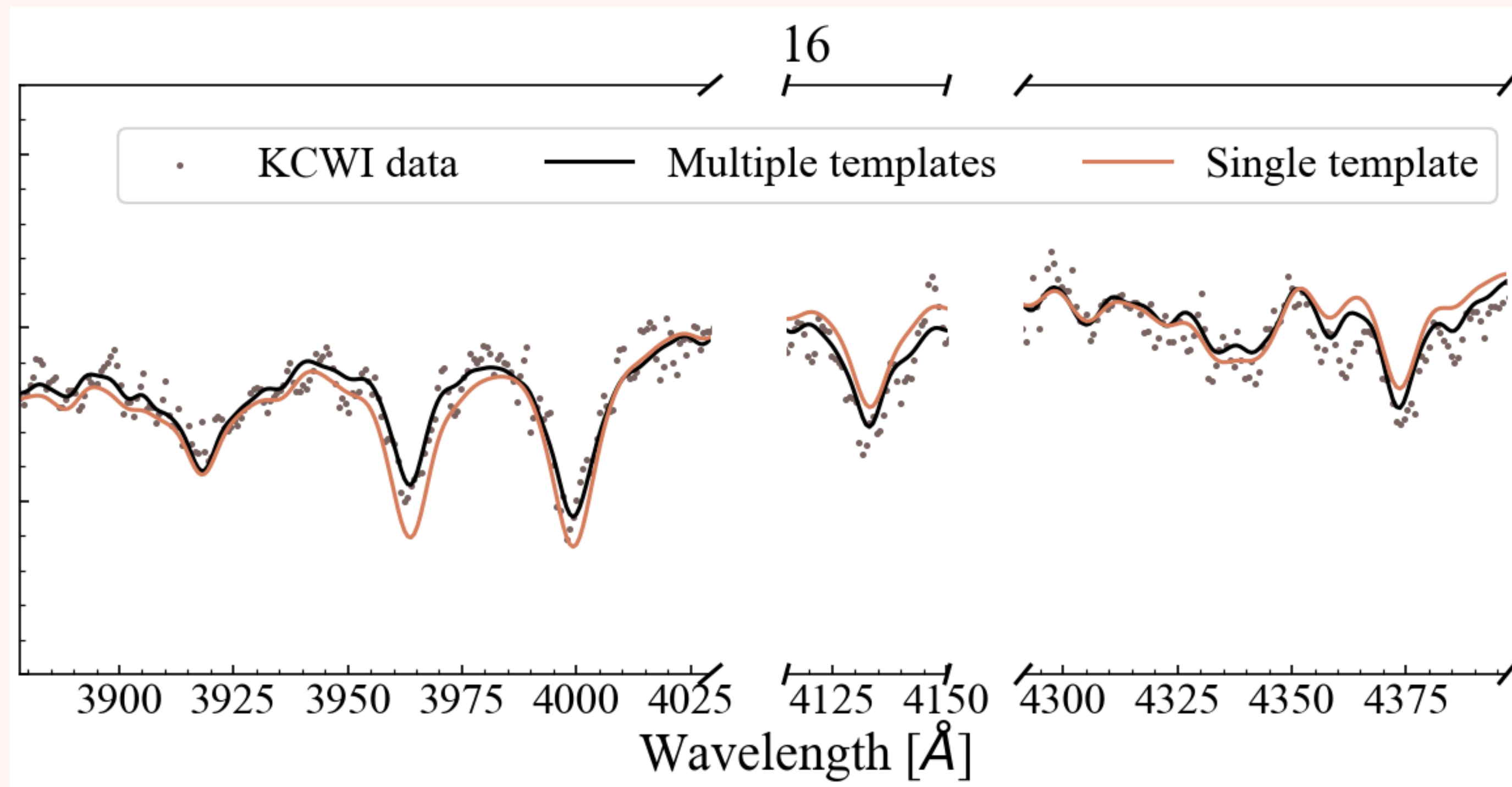
# WHAT ARE THEY?

● LSB Dwarf ● UDG ● Dwarf

## DFUWS Sample

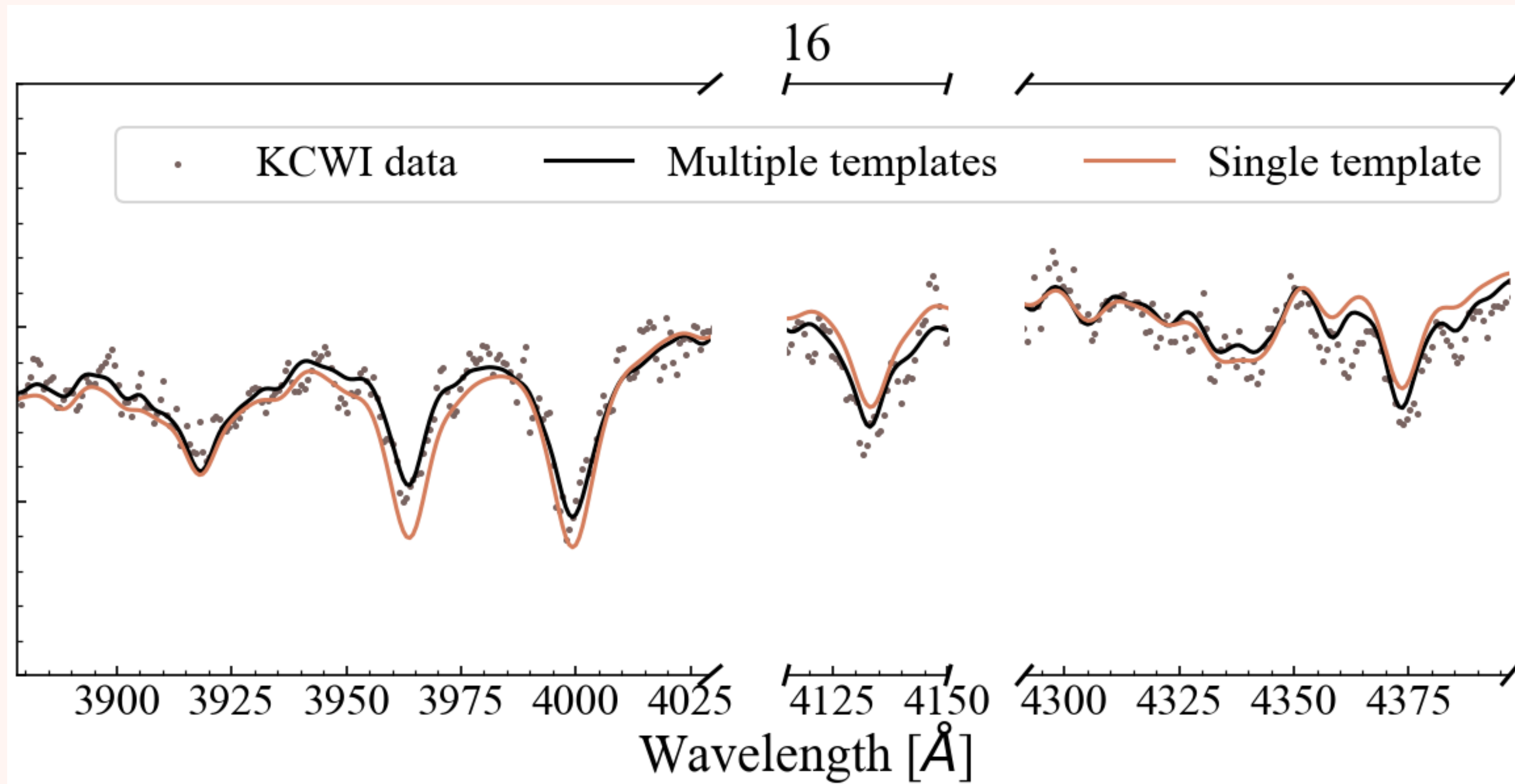


# MULTIPLE STELLAR POPPS?

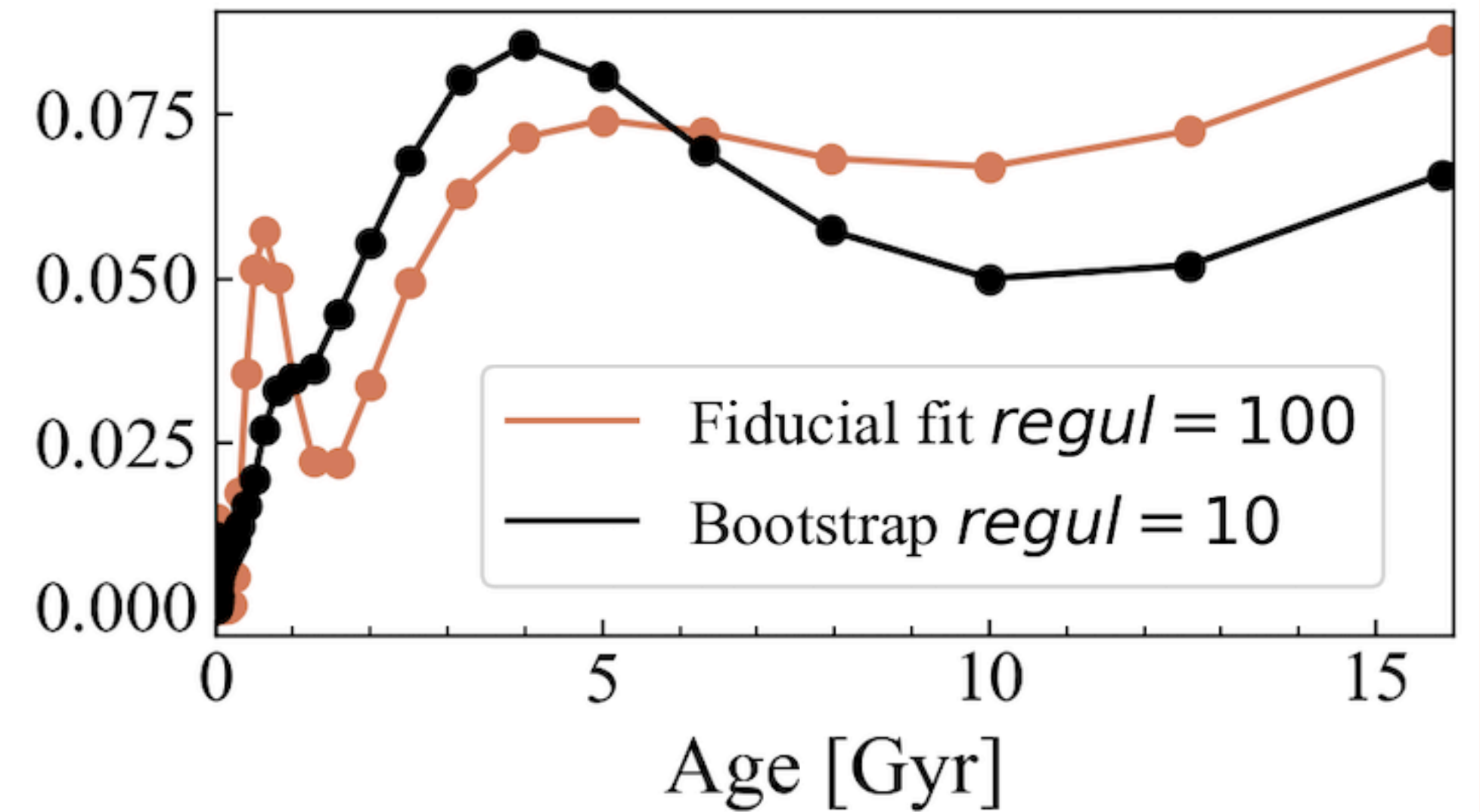




# MULTIPLE STELLAR POPS?

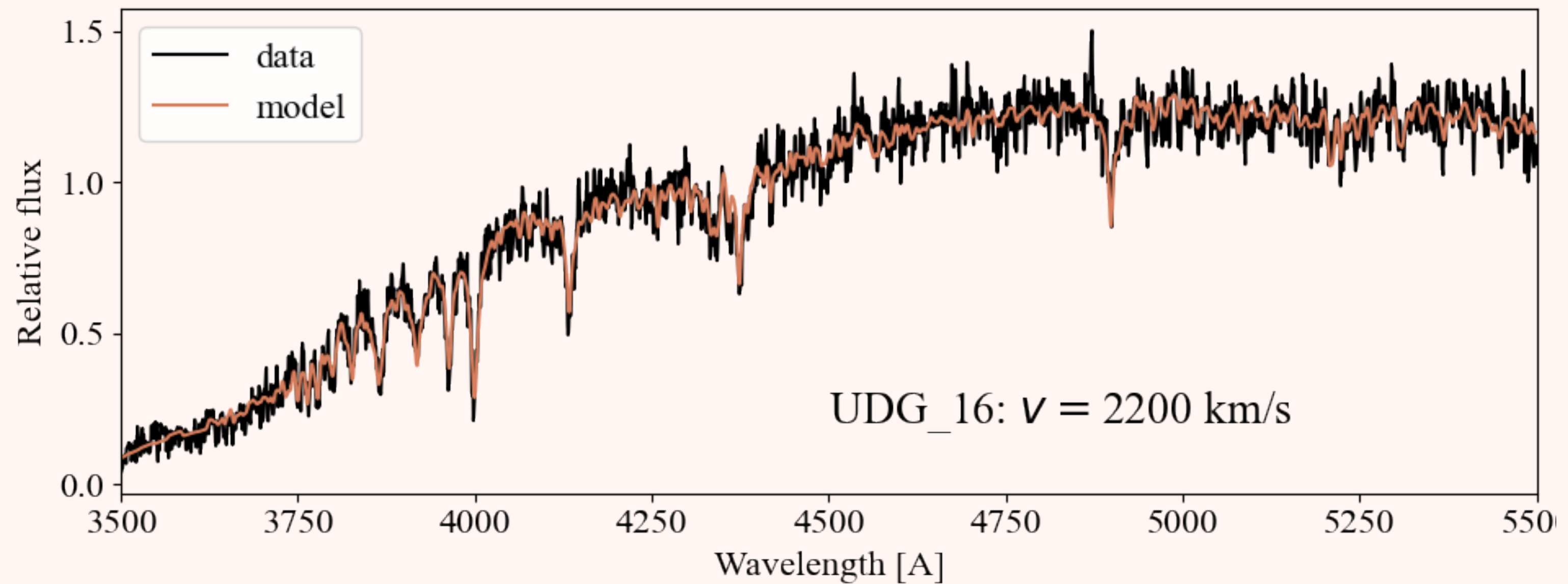
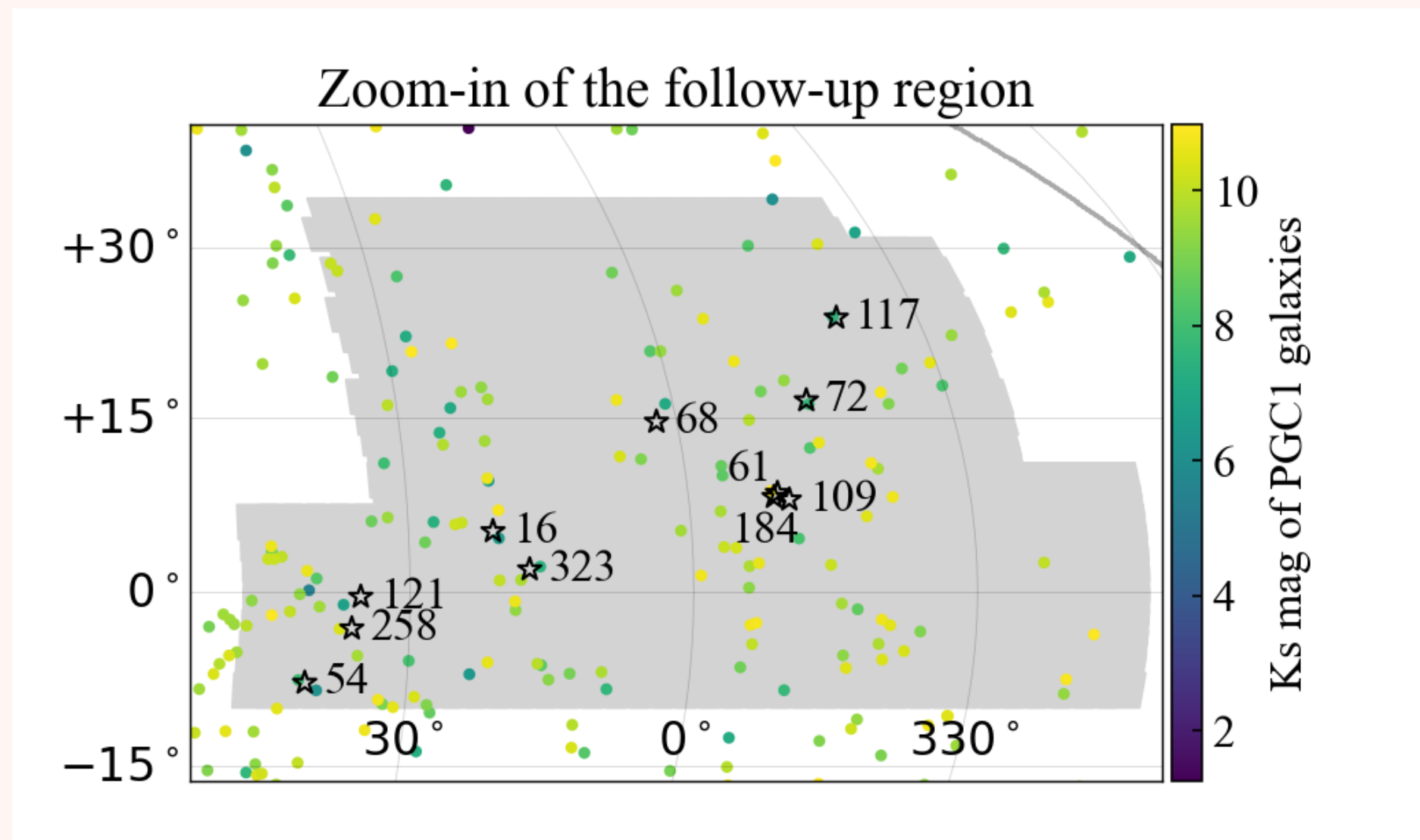


## Template weights from pPXF

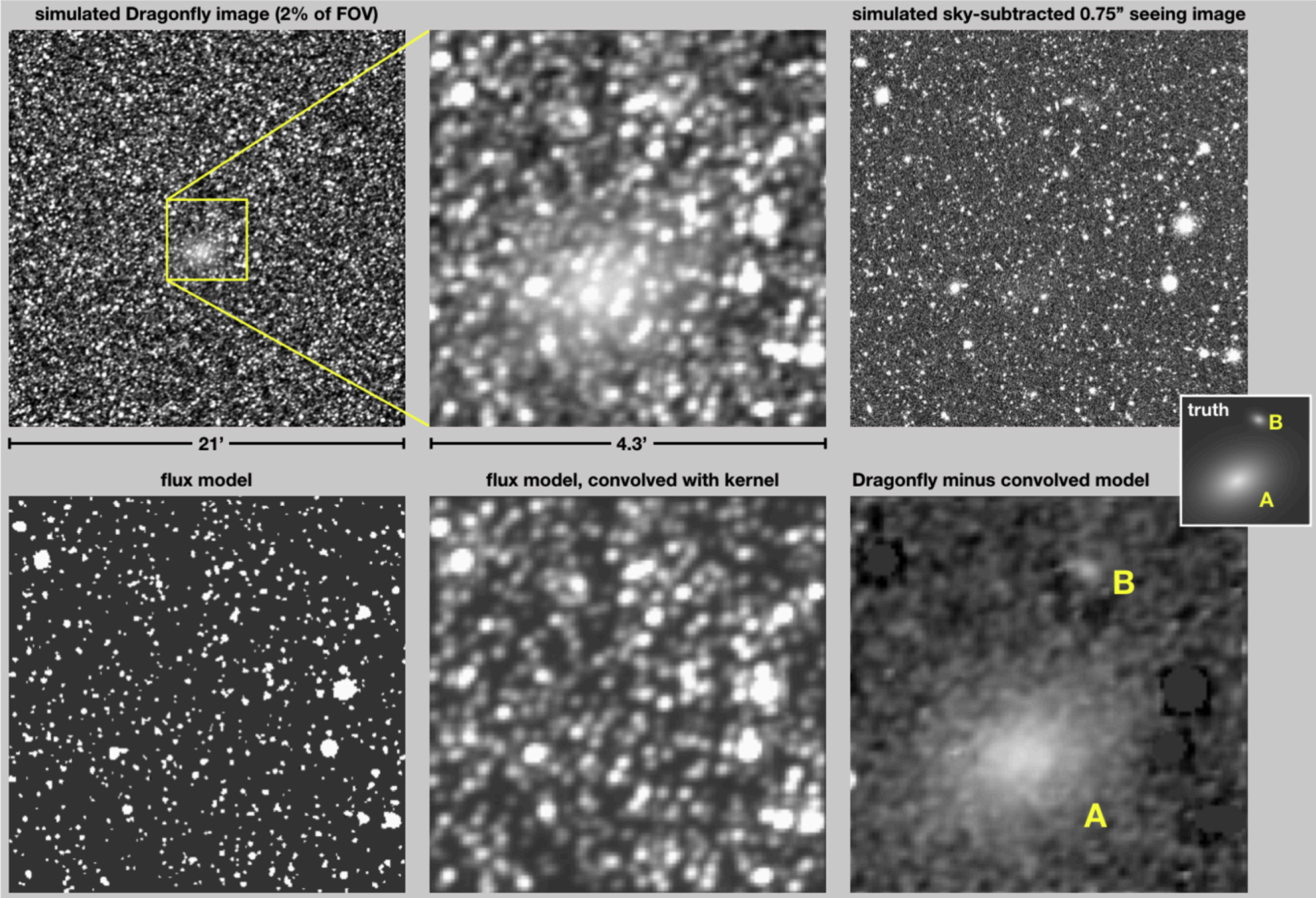


# SUMMARY

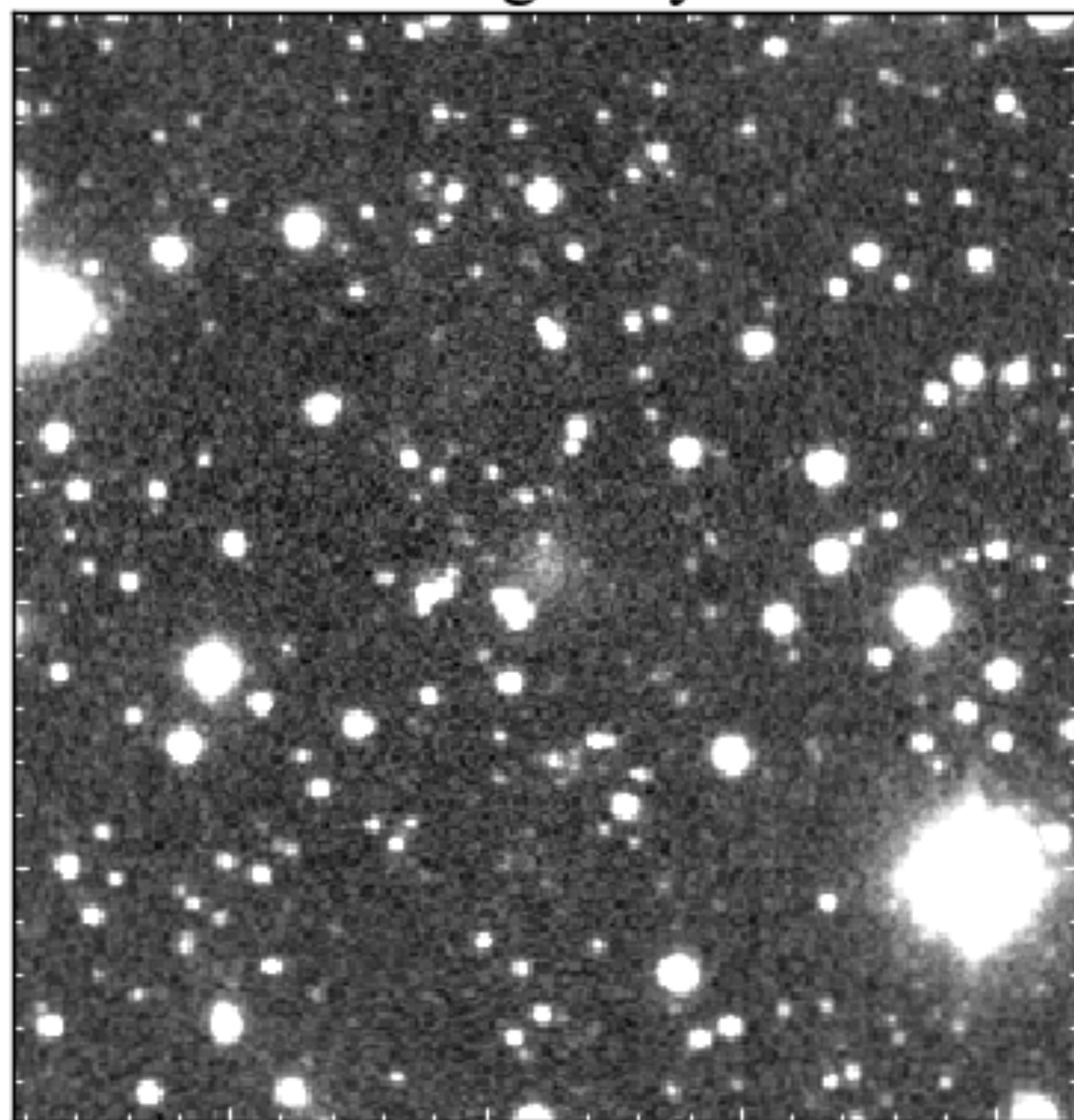
- **The Dragonfly Ultrawide Survey lets us find the biggest low-surface-brightness galaxies**
- **They are mostly UDGs, spanning a range of environments**
- **Multiple stellar pops → formation?**



# MULTI-RESOLUTION FILTERING



Dragonfly



23<sup>h</sup> 02<sup>m</sup> 00<sup>s</sup> 01<sup>m</sup> 48<sup>s</sup> 36<sup>s</sup> 24<sup>s</sup>

RA (ICRS)

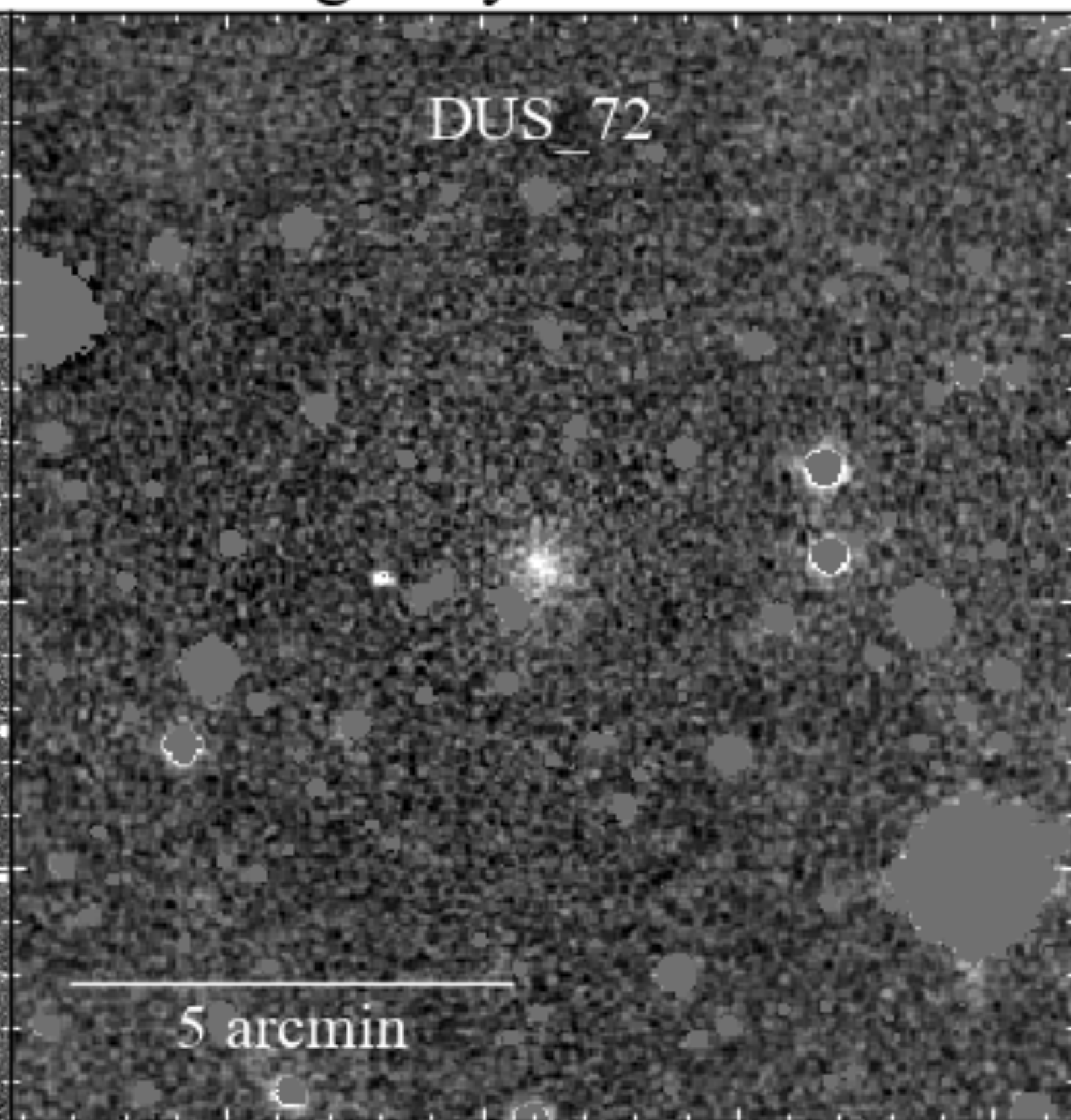
Legacy



23<sup>h</sup> 02<sup>m</sup> 00<sup>s</sup> 01<sup>m</sup> 48<sup>s</sup> 36<sup>s</sup> 24<sup>s</sup>

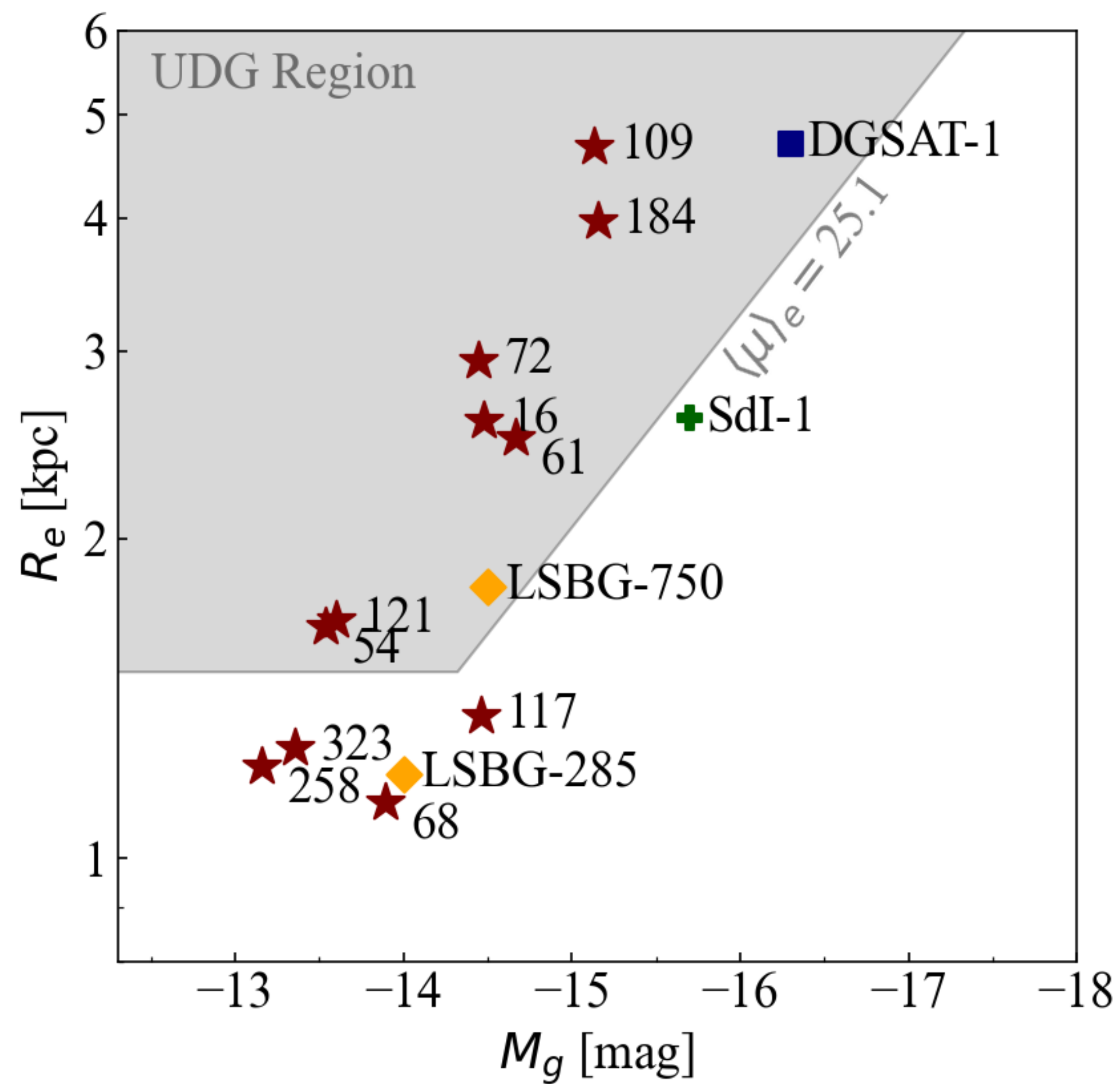
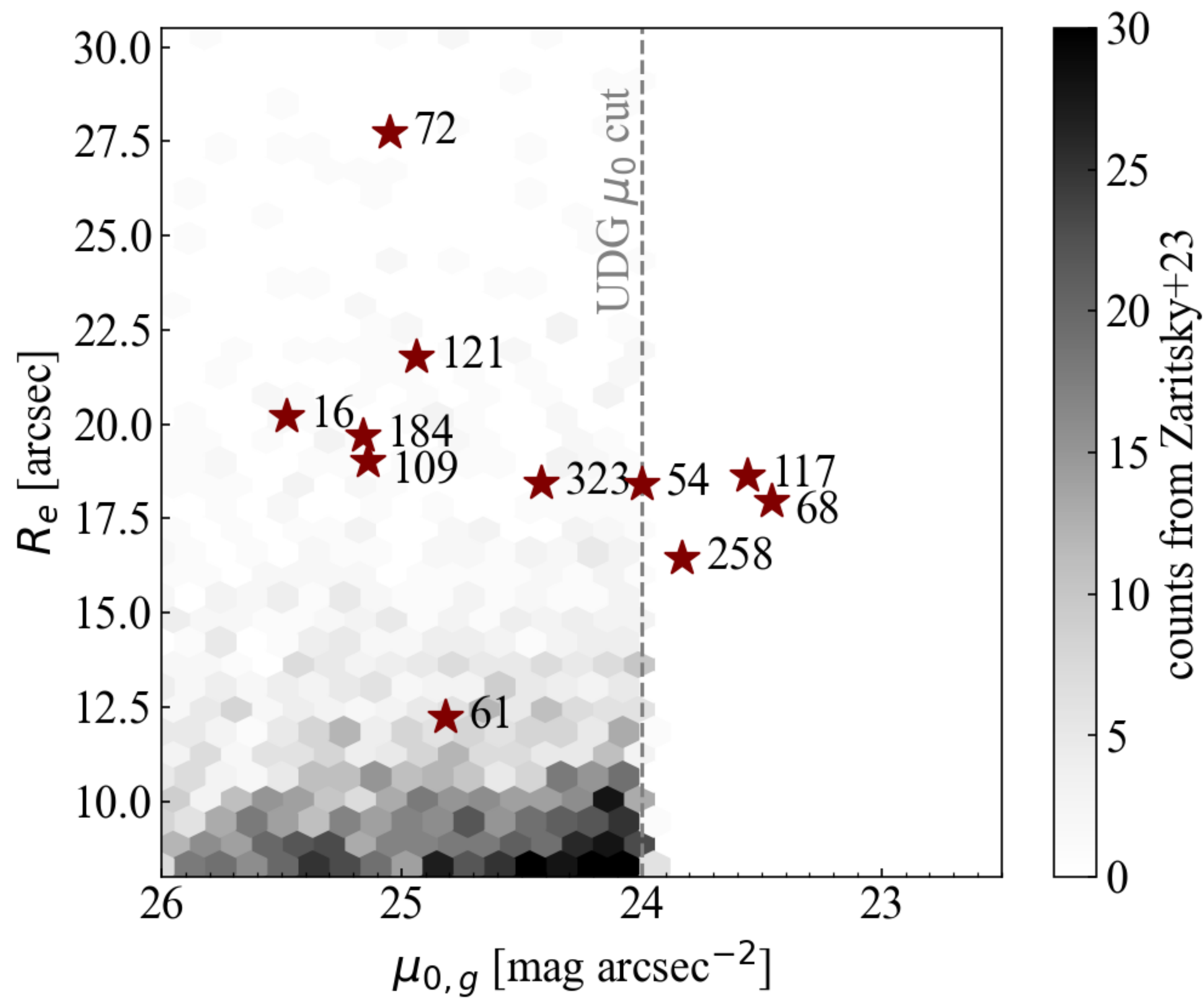
RA (ICRS)

Dragonfly After MRF



23<sup>h</sup> 02<sup>m</sup> 00<sup>s</sup> 01<sup>m</sup> 48<sup>s</sup> 36<sup>s</sup> 24<sup>s</sup>

RA (ICRS)



Injected  $v=2000$  km/s, recovered  $v=1992$  km/s

