Nearby Galaxies with UVEX and Roman

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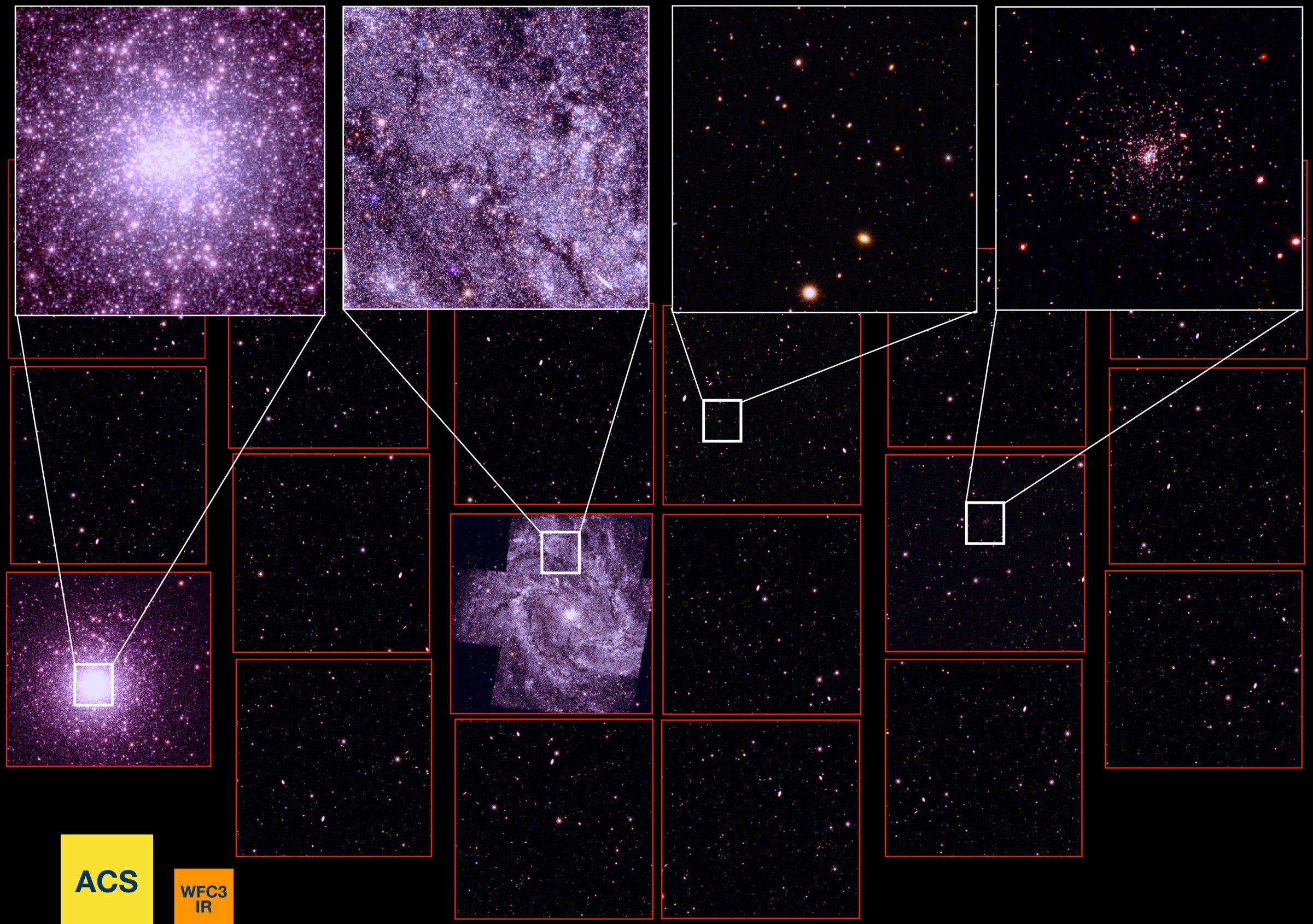
Nearby Galaxies Are Great for Astrophysics

- Detailed view of processes and context simultaneously
- Sensitive to galaxy evolution and cosmology
- Anchor our knowledge for interpretation of more distant universe
- Large samples - Subdivide for specific goals
- Cover a wide range of galaxy properties

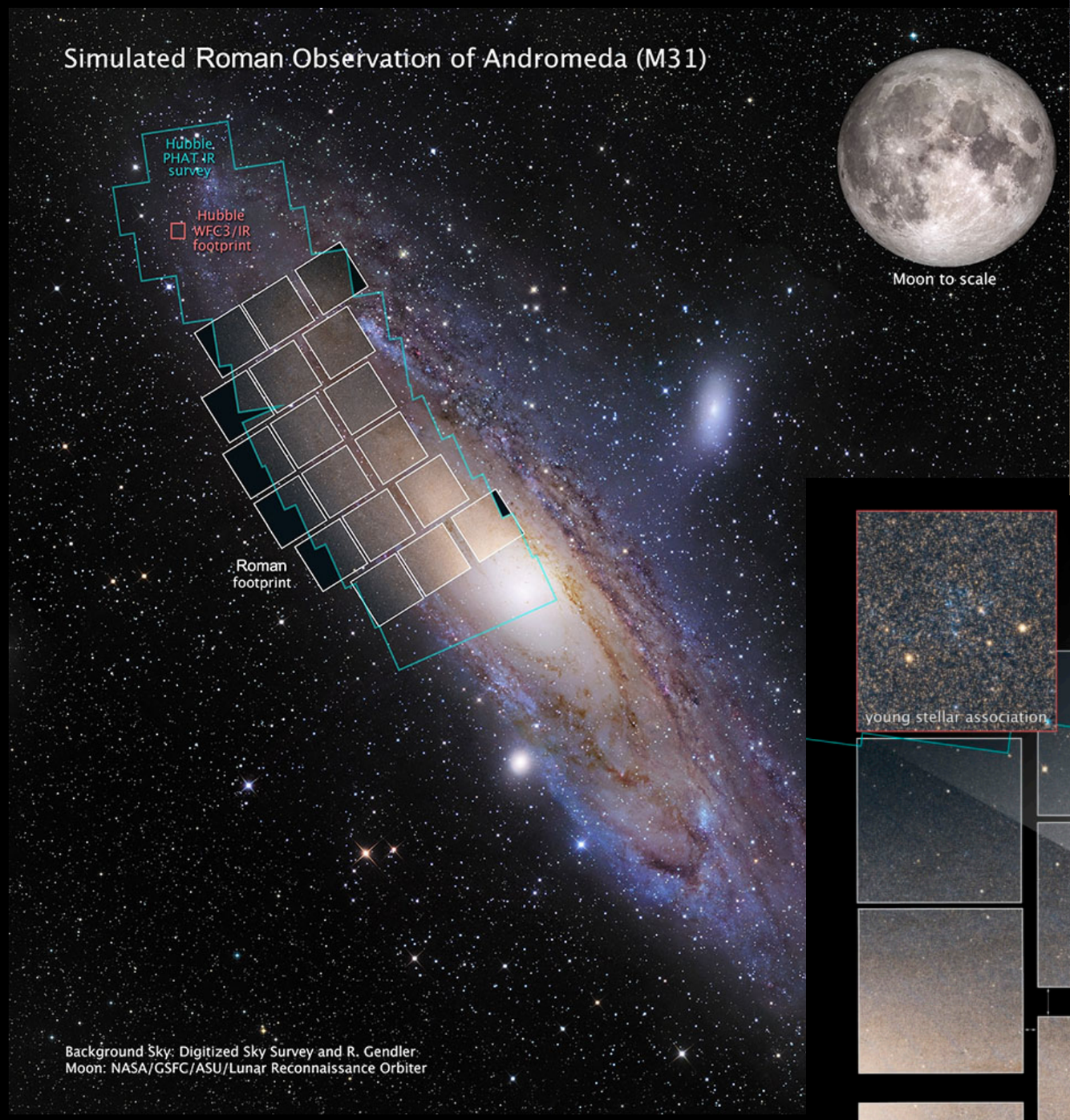


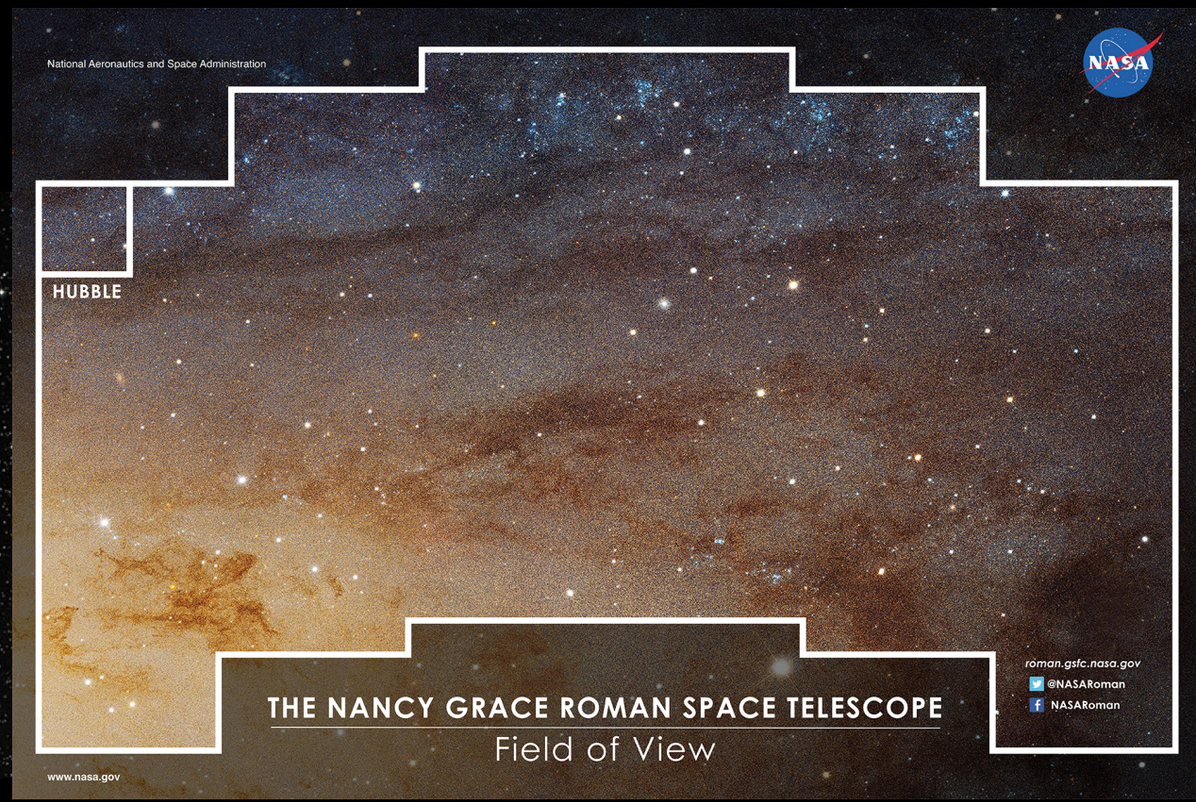
Akeson et al. 2019

Roman + UVEX

- Roman detects and constrains old stars - Trace galaxy formation and long-term evolution
- UVEX detects and constrains massive stars - Trace star formation, disk structure, winds, mass loss, metal enrichment, SN feedback
- Roman+UVEX will help separate outer disk and halo
- Should consider going deeper with UVEX on nearby galaxies.

PHAT + GALEX
provides taste of Roman+UVEX


Simulated Roman Observation of Andromeda (M31)
Hubble PHAT IR survey
Hubble WFC3/IR footprint
Roman footprint
Moon to scale
Background Sky: Digitized Sky Survey and R. Gendler
Moon: NASA/GSFC/ASU/Lunar Reconnaissance Orbiter


National Aeronautics and Space Administration
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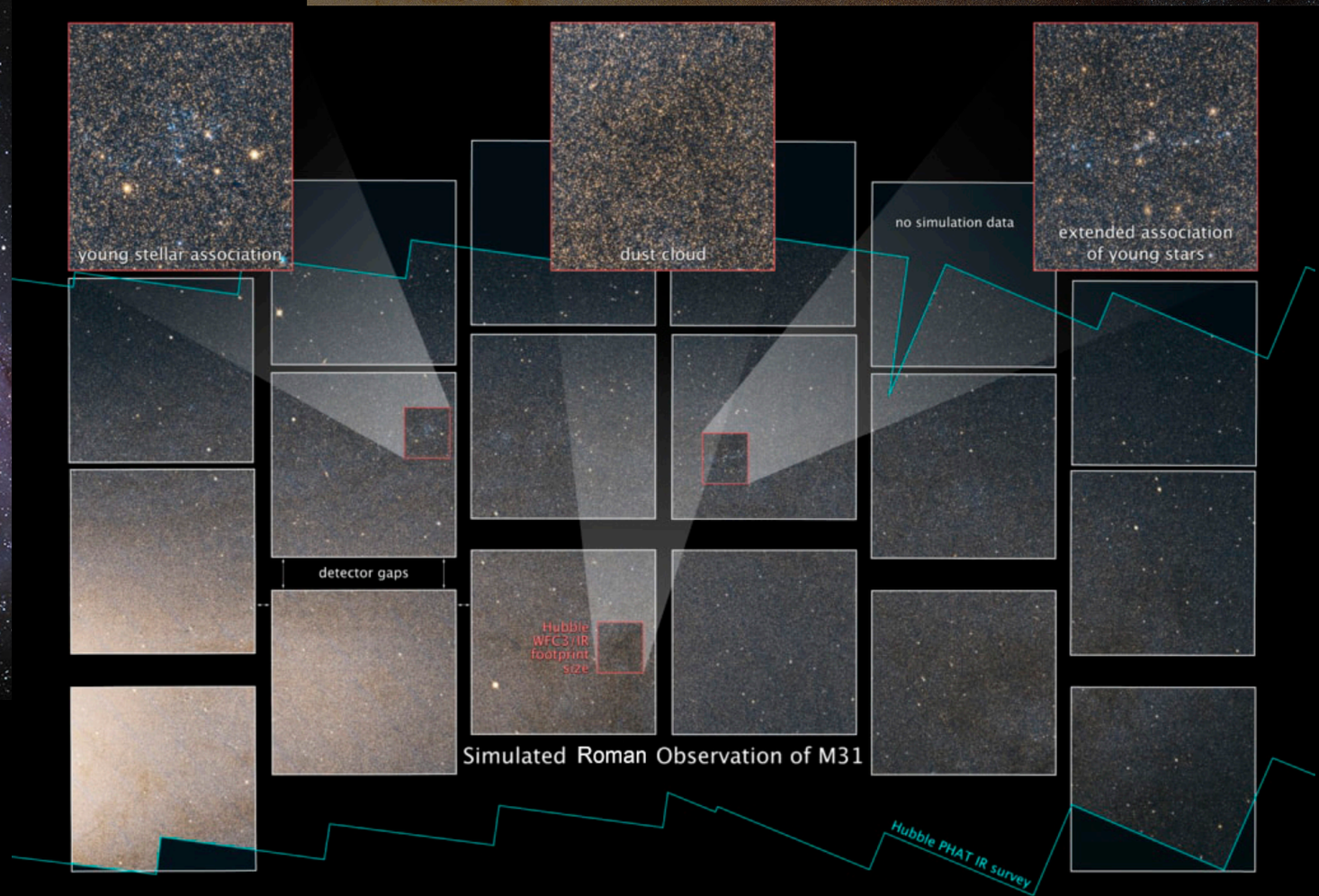
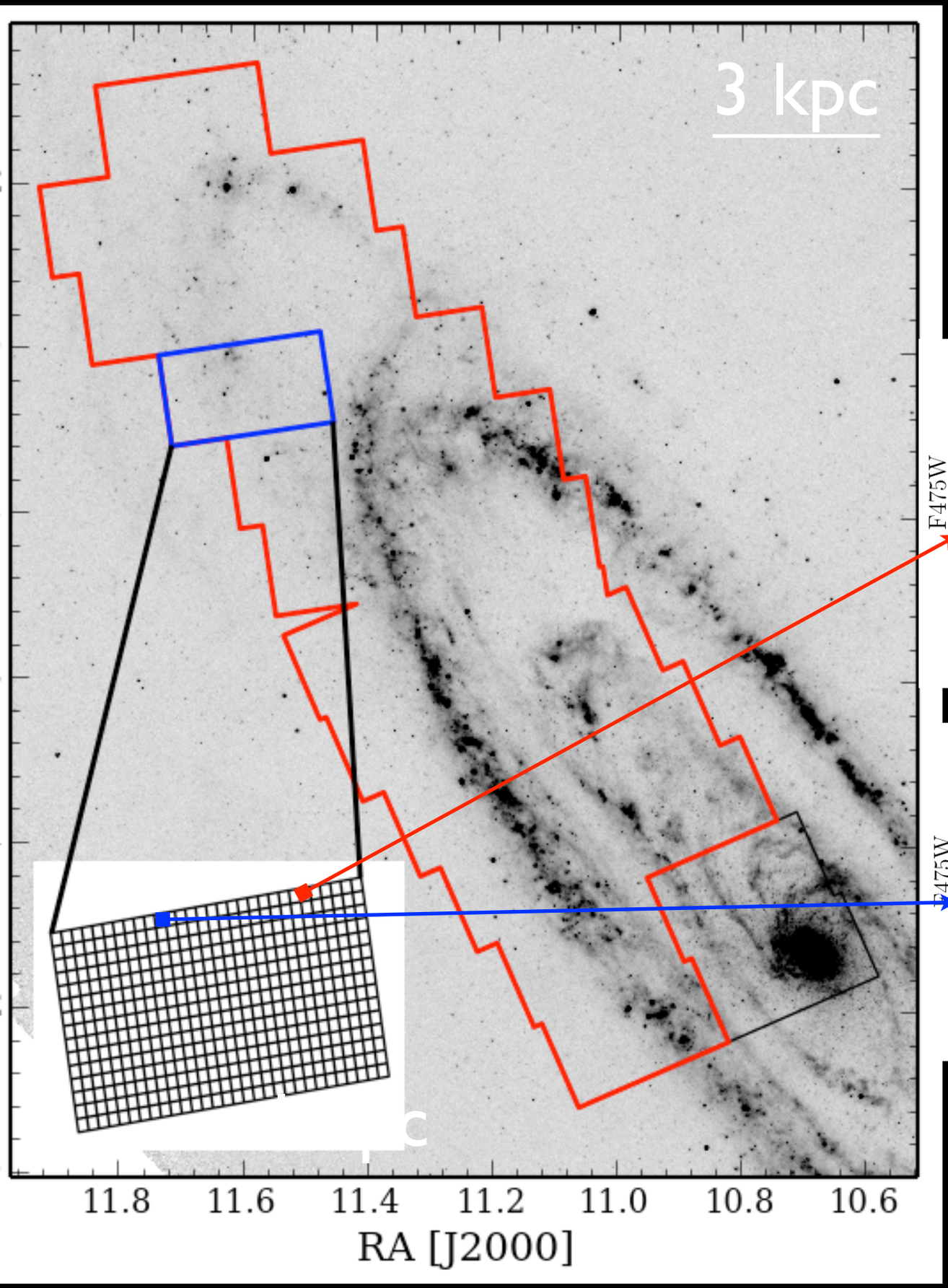
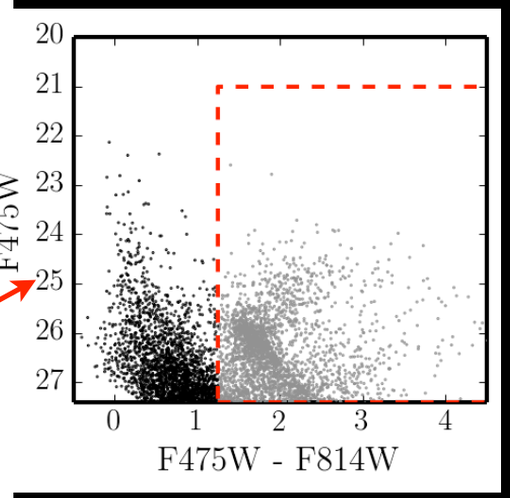
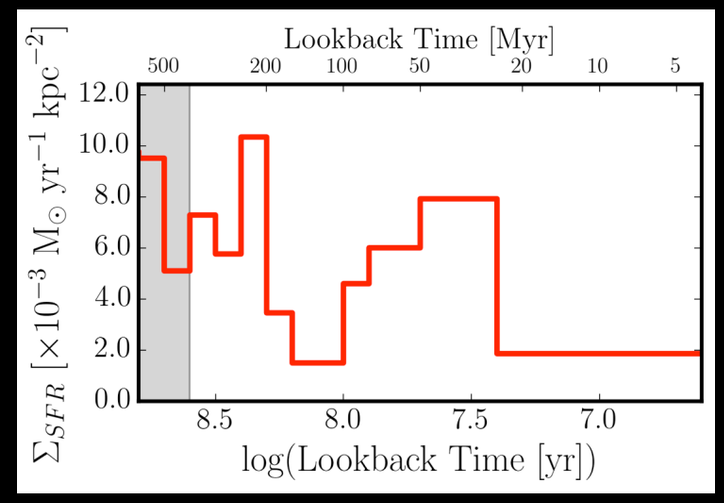

young stellar association
dust cloud
no simulation data
extended association of young stars
detector gaps
Hubble WFC3/IR footprint size
Simulated Roman Observation of M31
Hubble PHAT IR survey

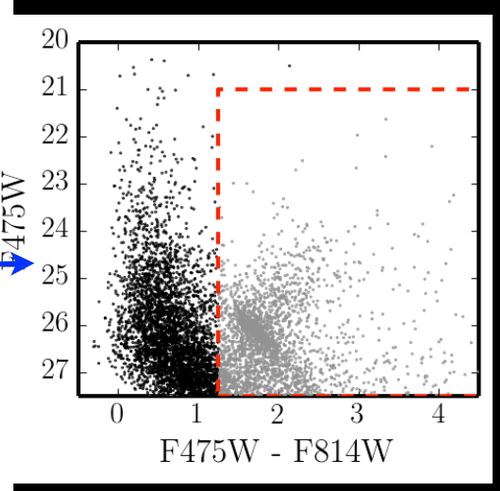
~9000 regions

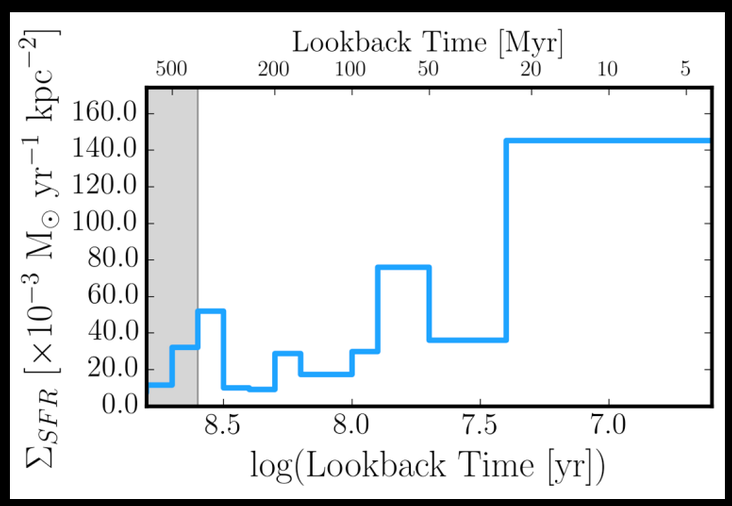
100pc x 100pc
(projected size)



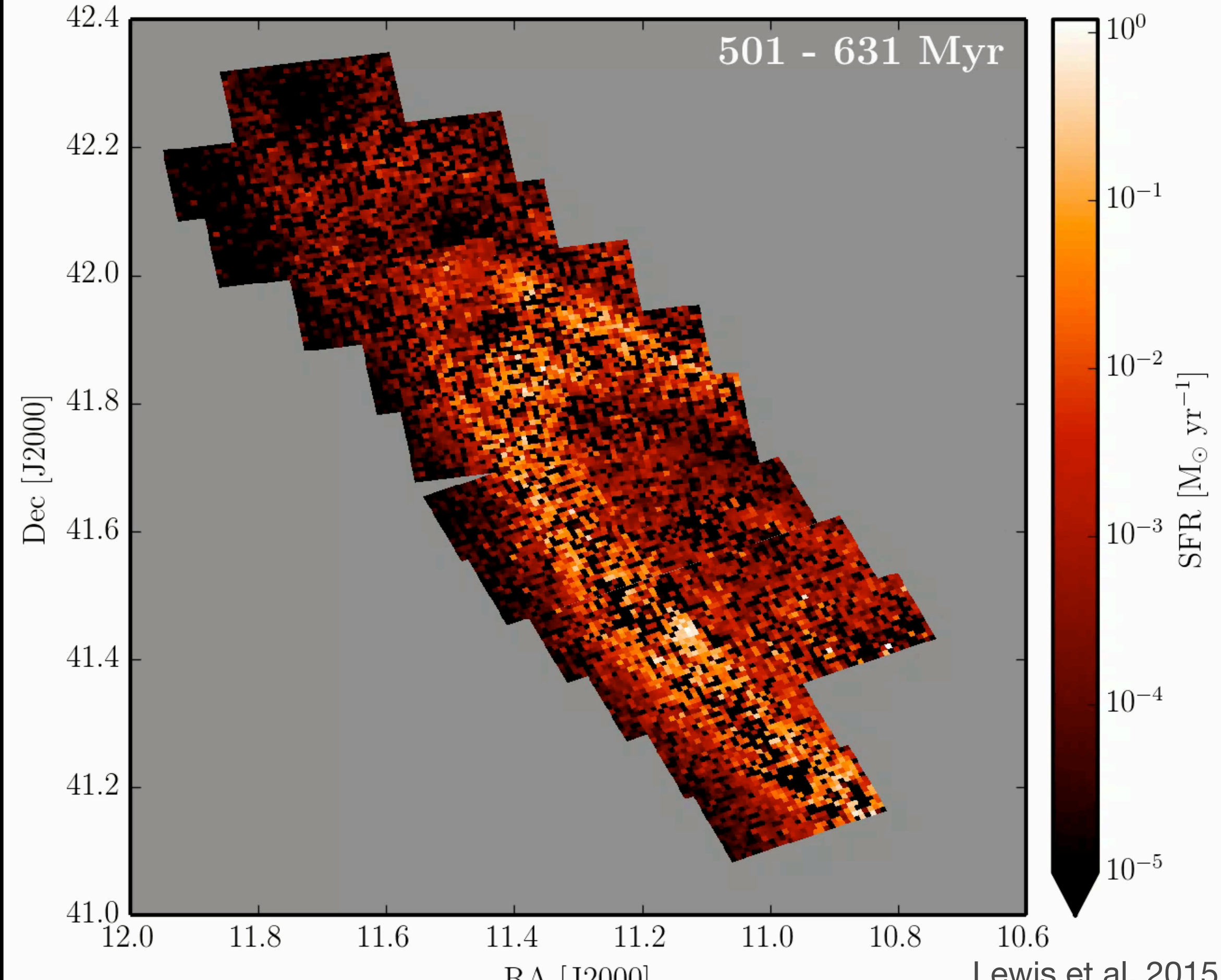








Lewis et al. 2015



Lewis et al. 2015

GALEX FUV (observed)

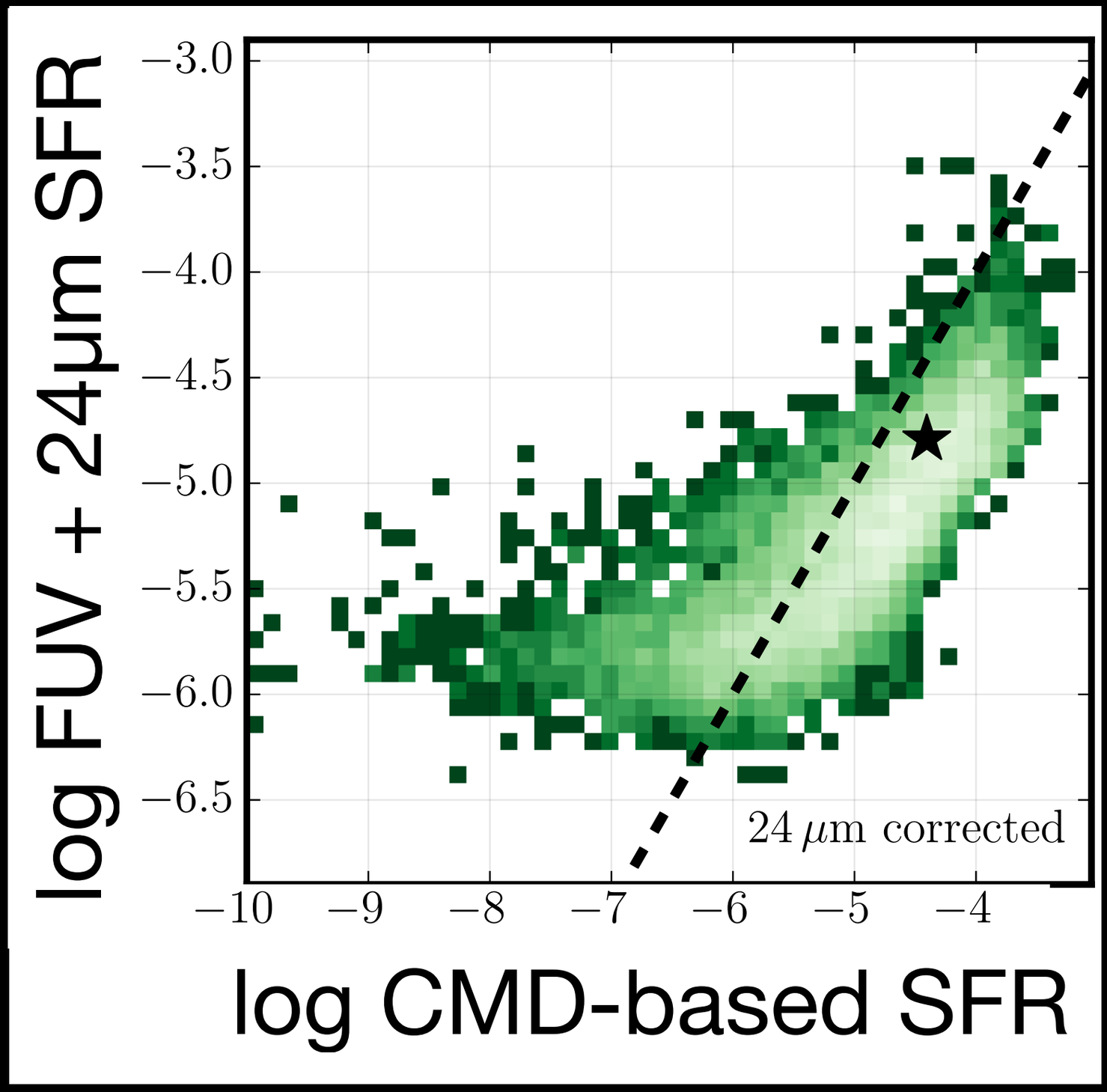
$f^{\mathrm{SFH}}_{\mathrm{FUV}}$

Dust-free GALEX FUV (predicted)

Tests of star formation rate indicators & interpretation of UV flux

Lewis et al 2017

Standard SFR's underestimated

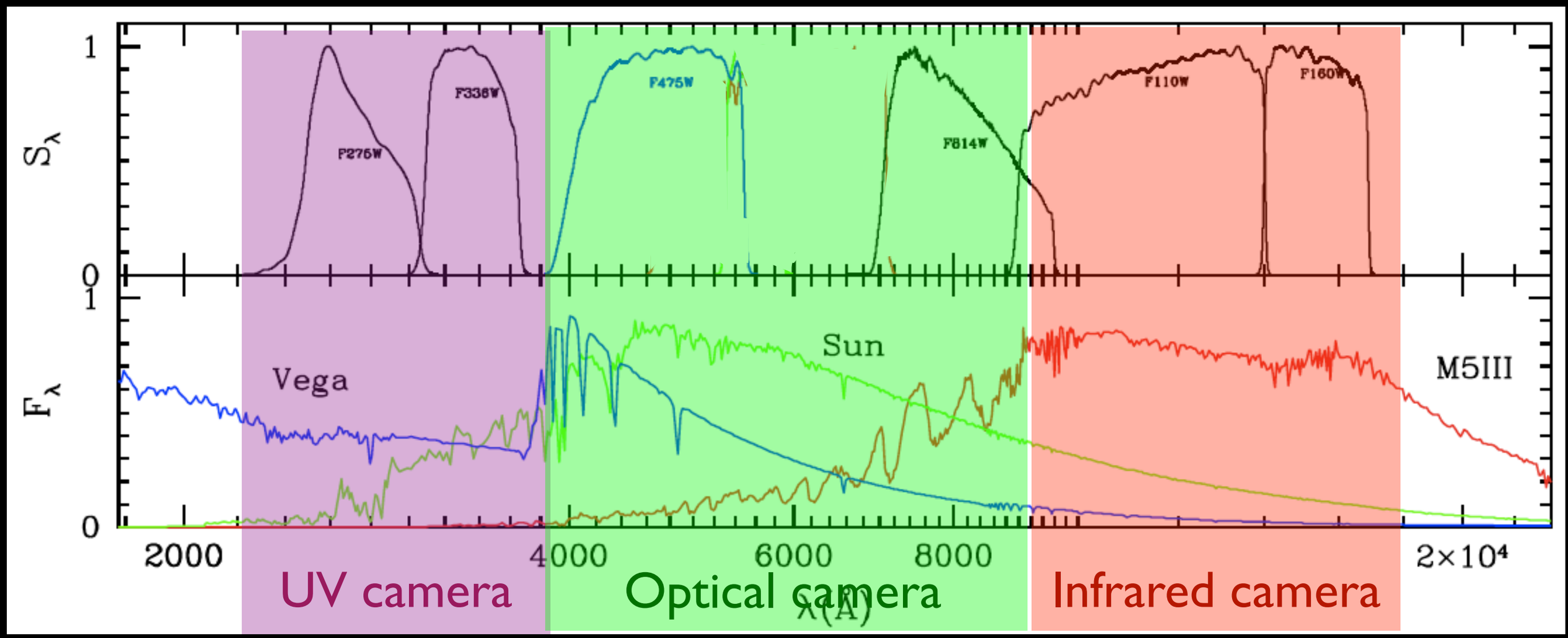


Roman + UVEX will make this kind of work common

Lewis et al 2017

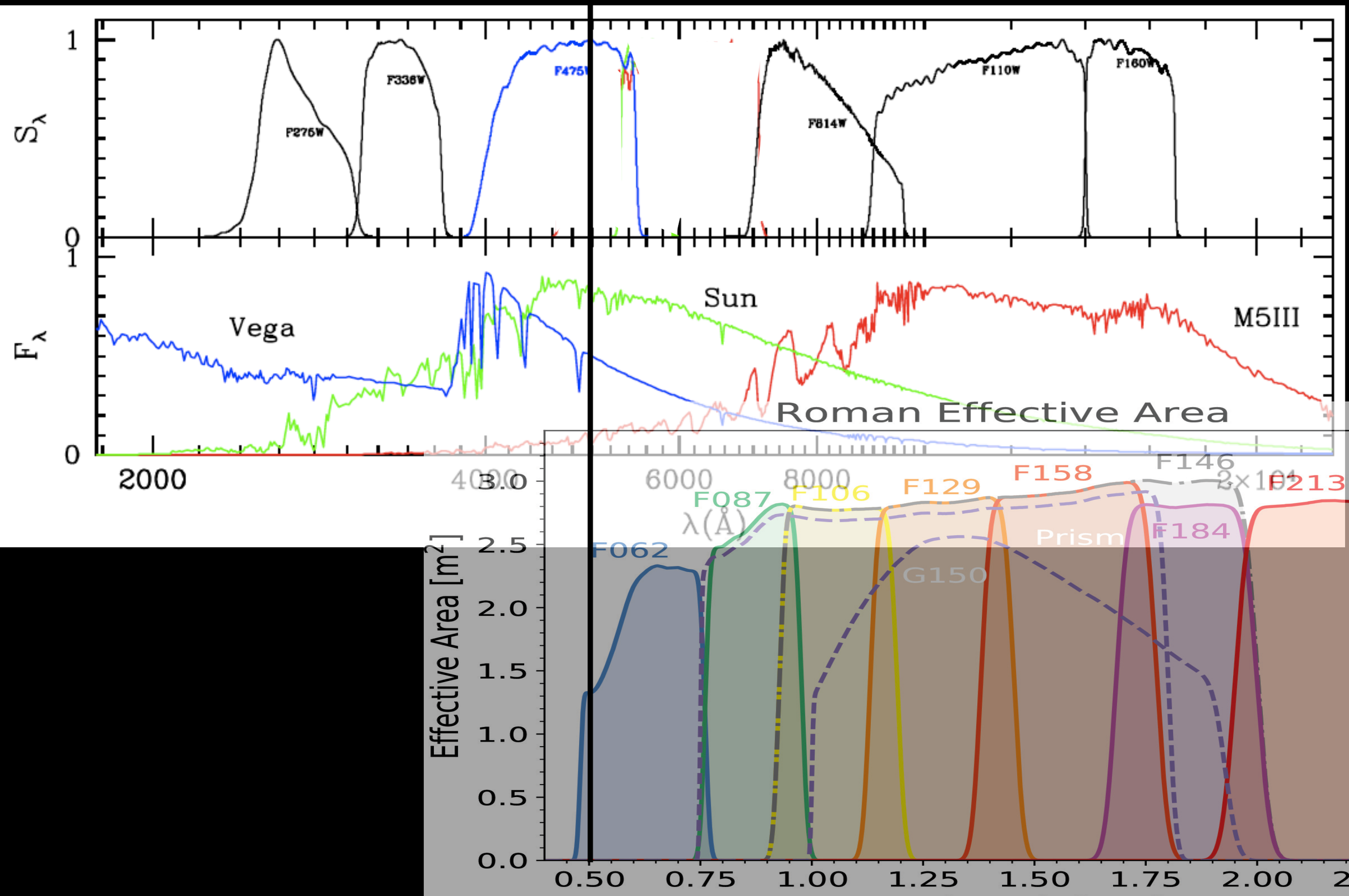
Correction based on Spitzer emission

Roman isn't quite PHAT:



PHAT had ultraviolet optical and infrared measurements

Roman is limited to >5000 Angstroms



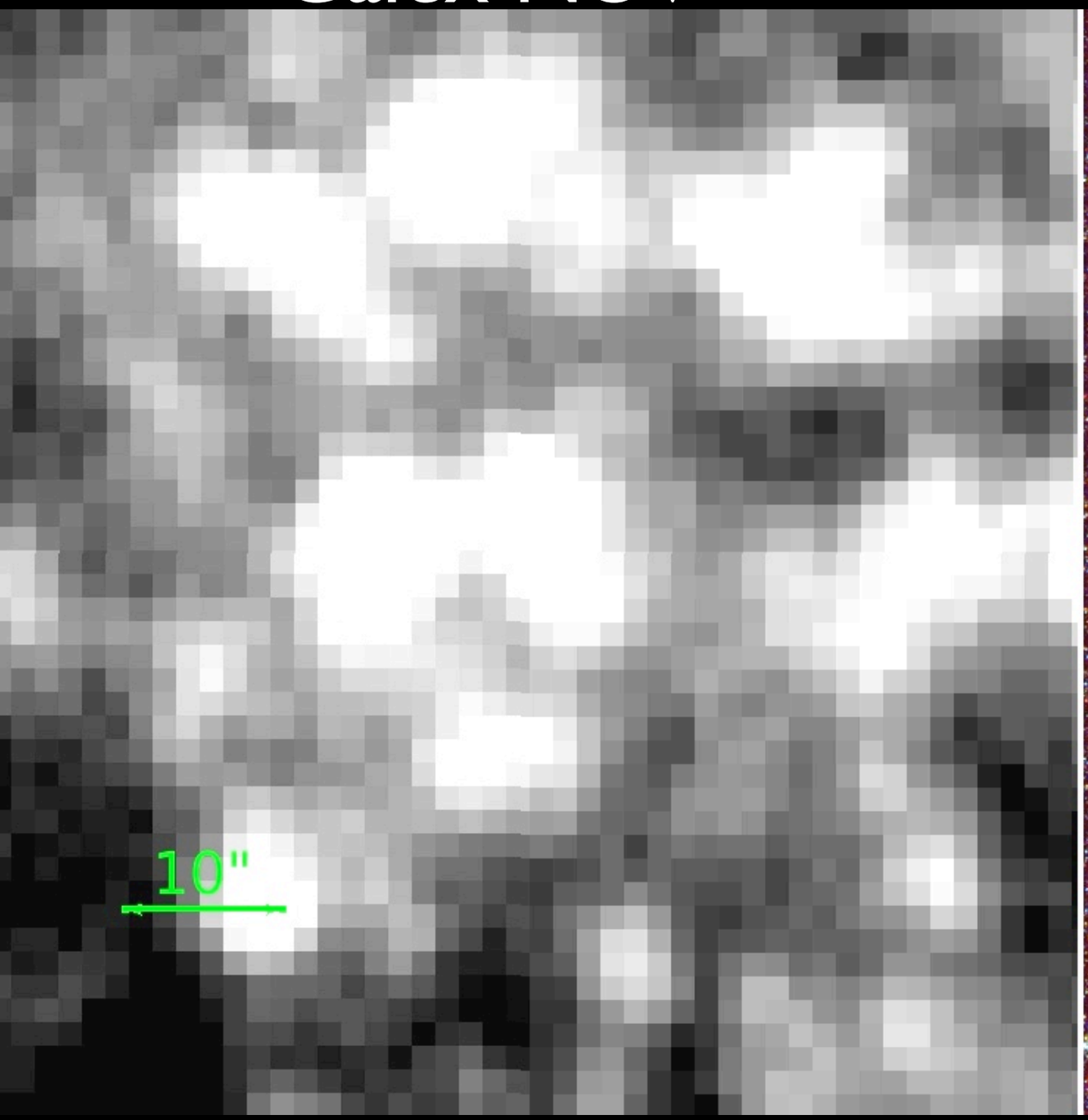
Galex

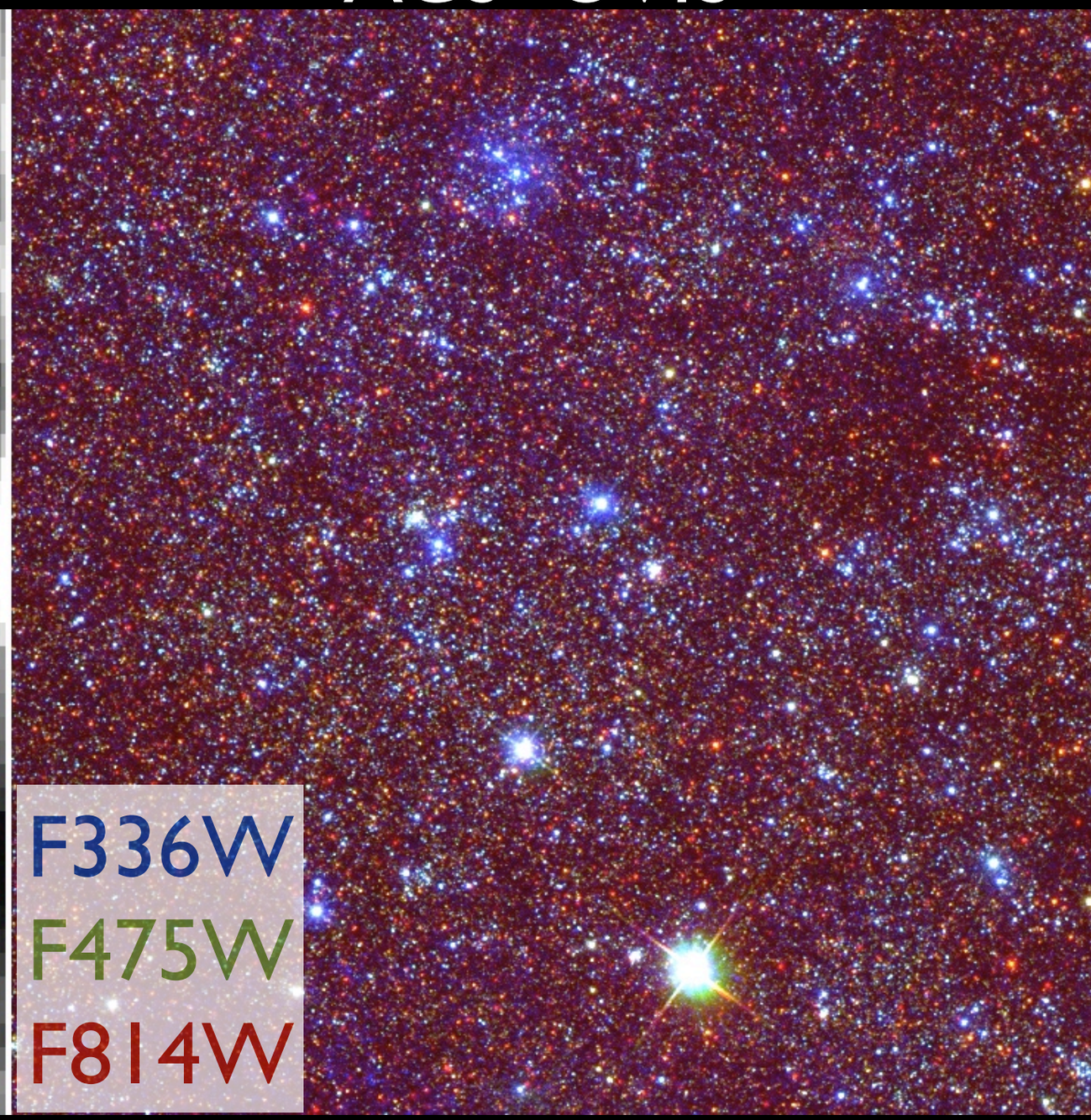
Galex Team, Caltech, NASA

UVEX will resolve some massive stars

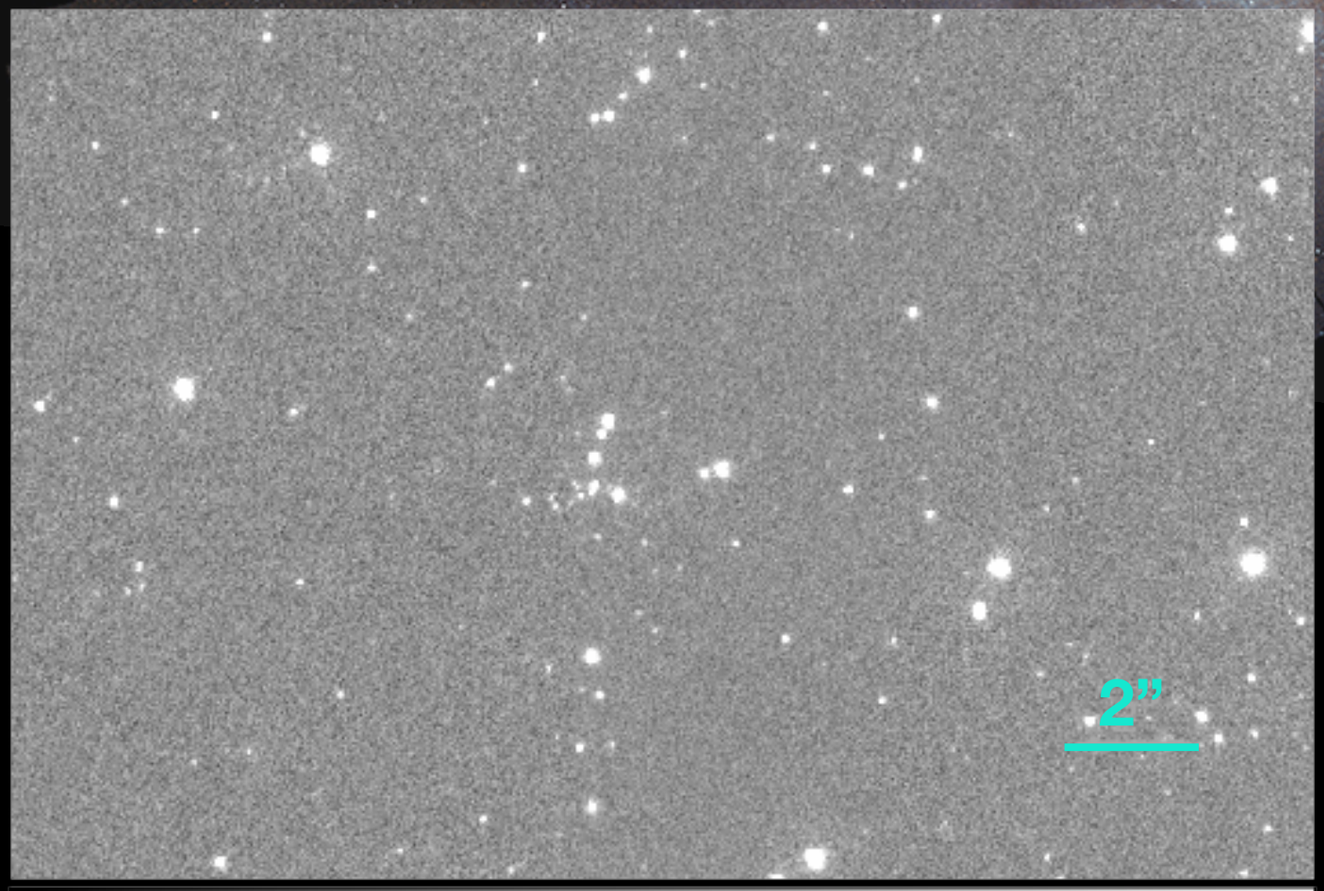
Galex NUV

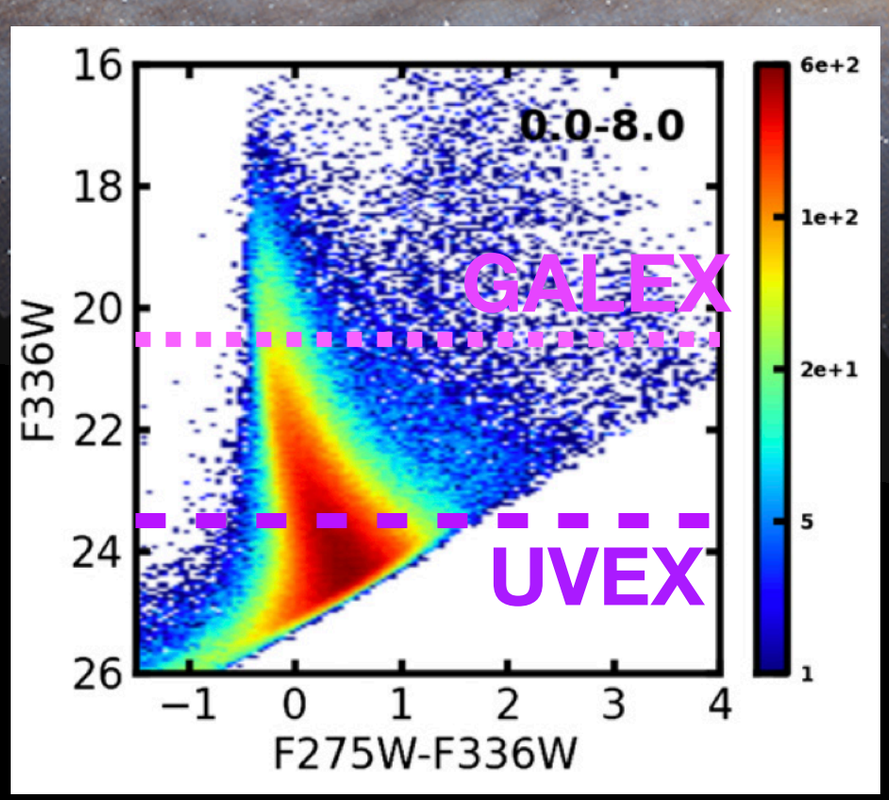
ACS+UVIS





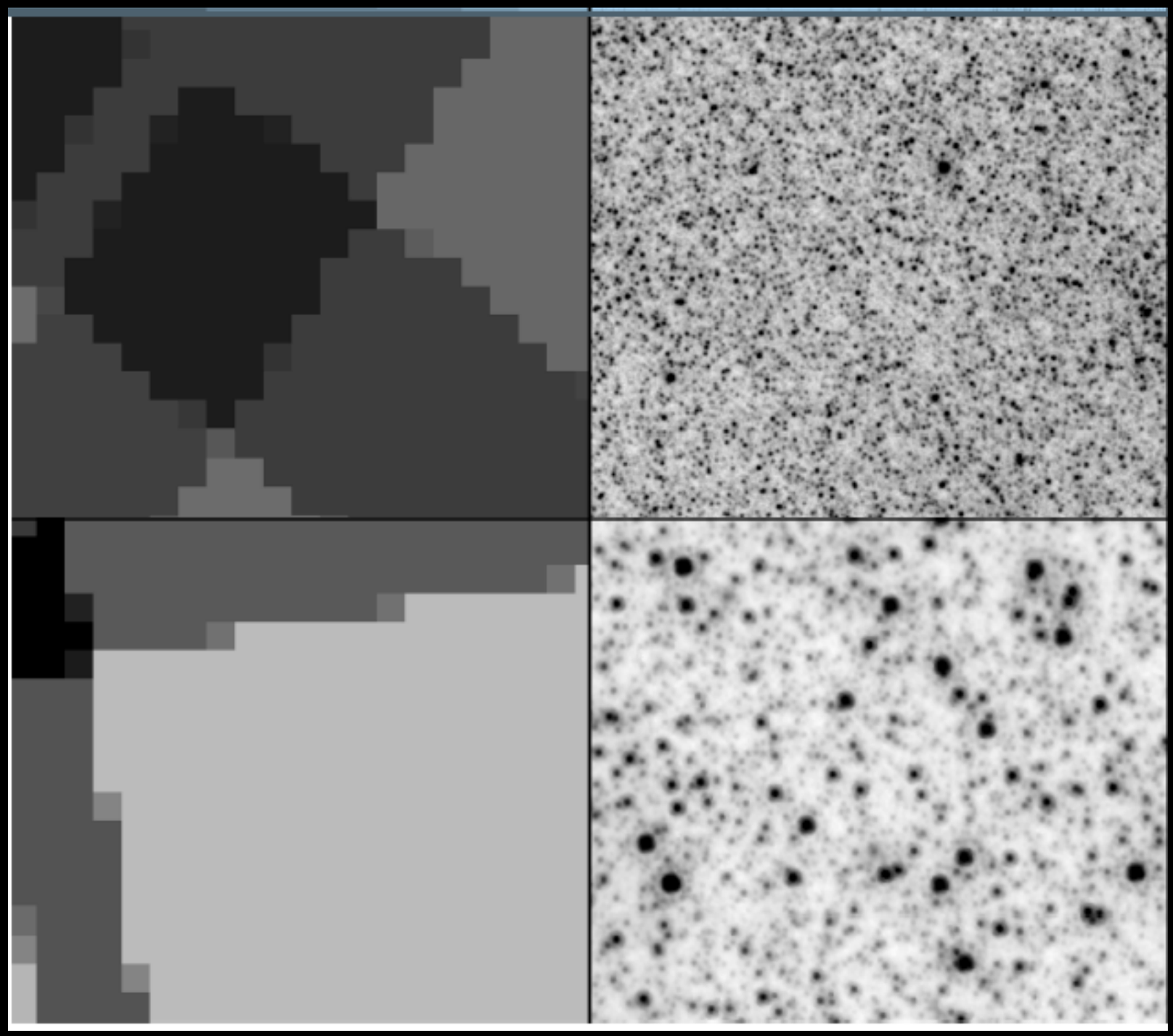
UV Often Sparse





Leveraging the higher resolution imaging

Example from PHAT



F475W

F160W

Identical 17”x17” fields
Seamless boundaries
Lower resolution in IR

(Williams et al. 2014)

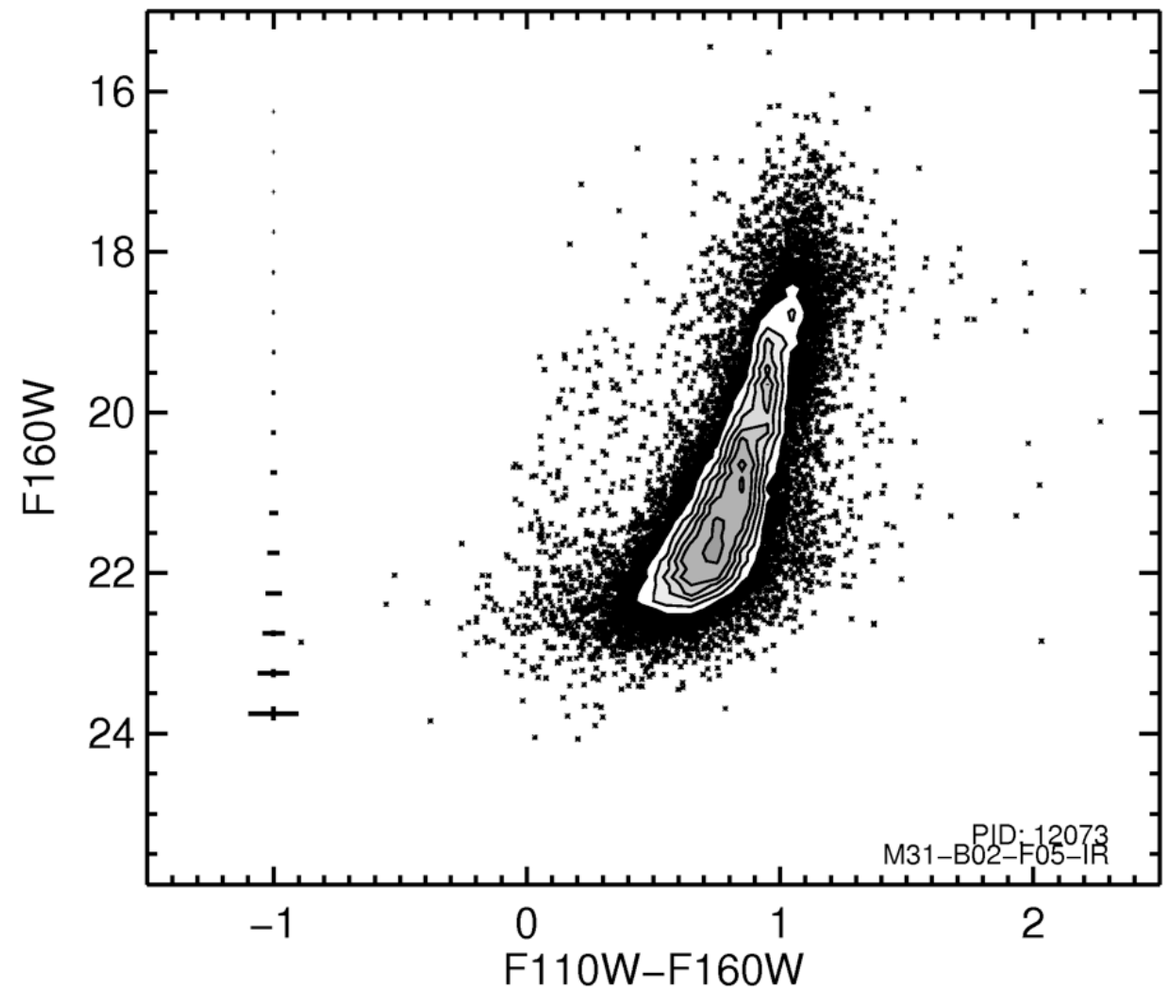
Exposure

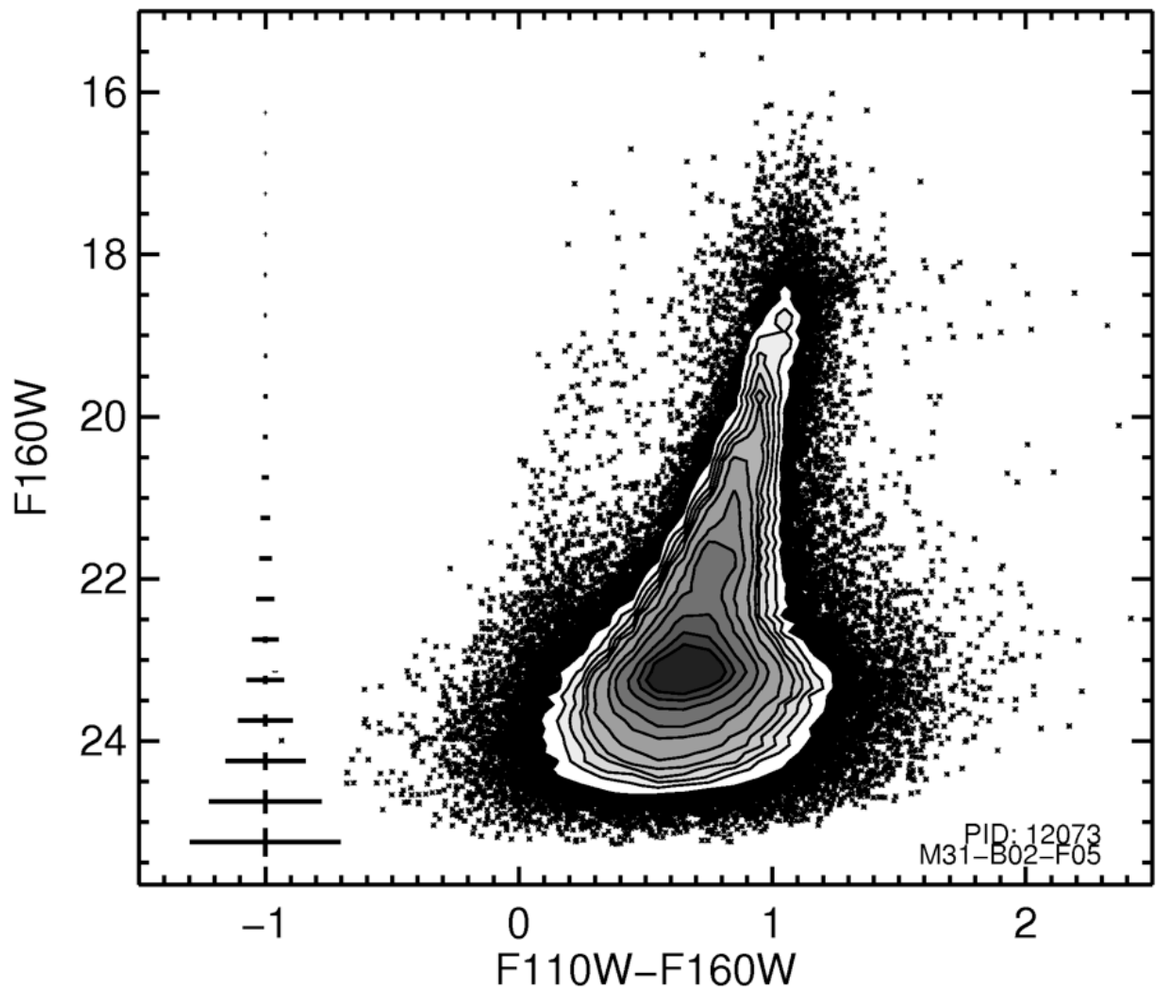
Image

Improved Depth for Low-Resolution Bands
May also work for Roman/UVEX

IR Data Only

All bands included

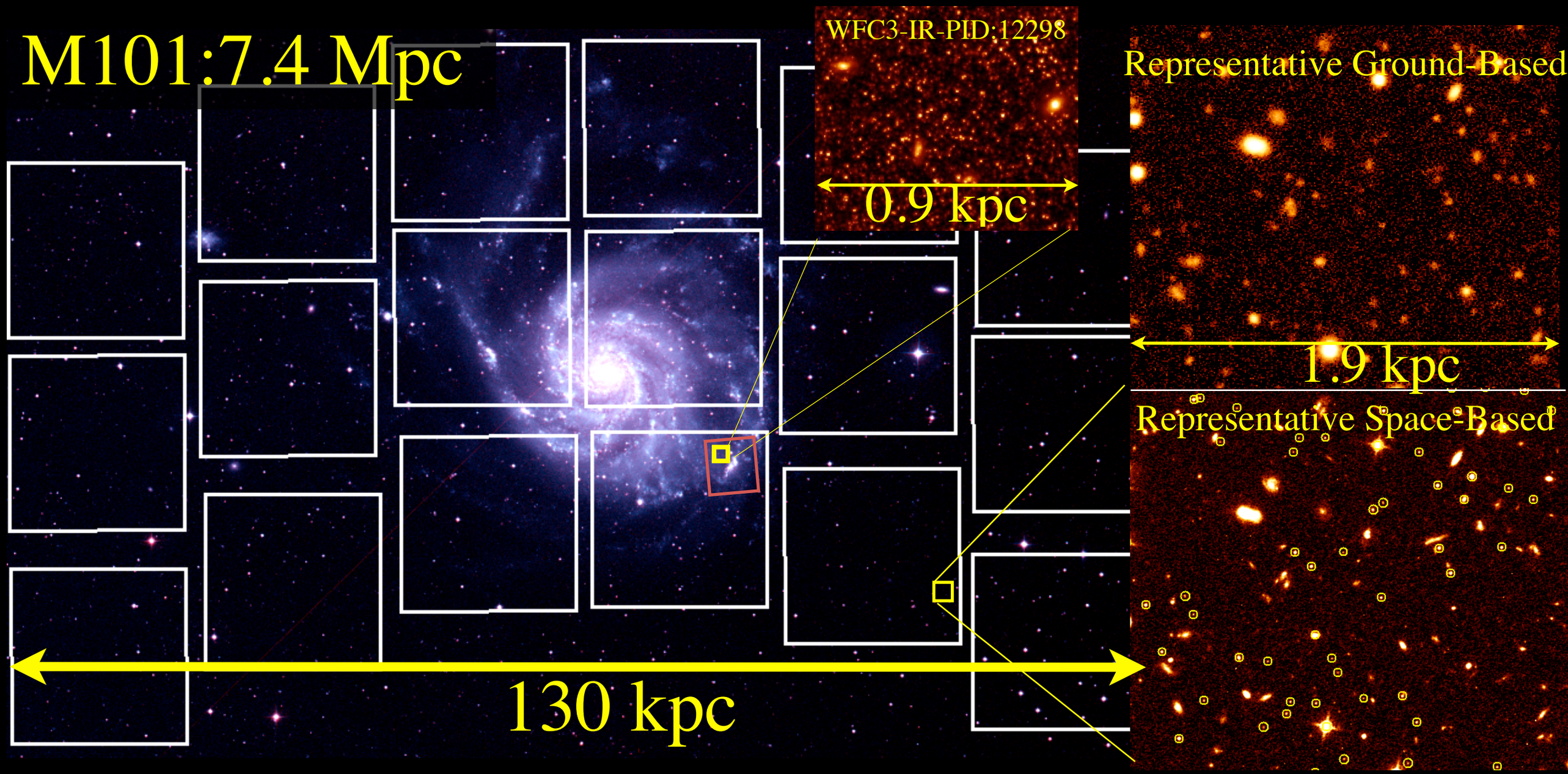




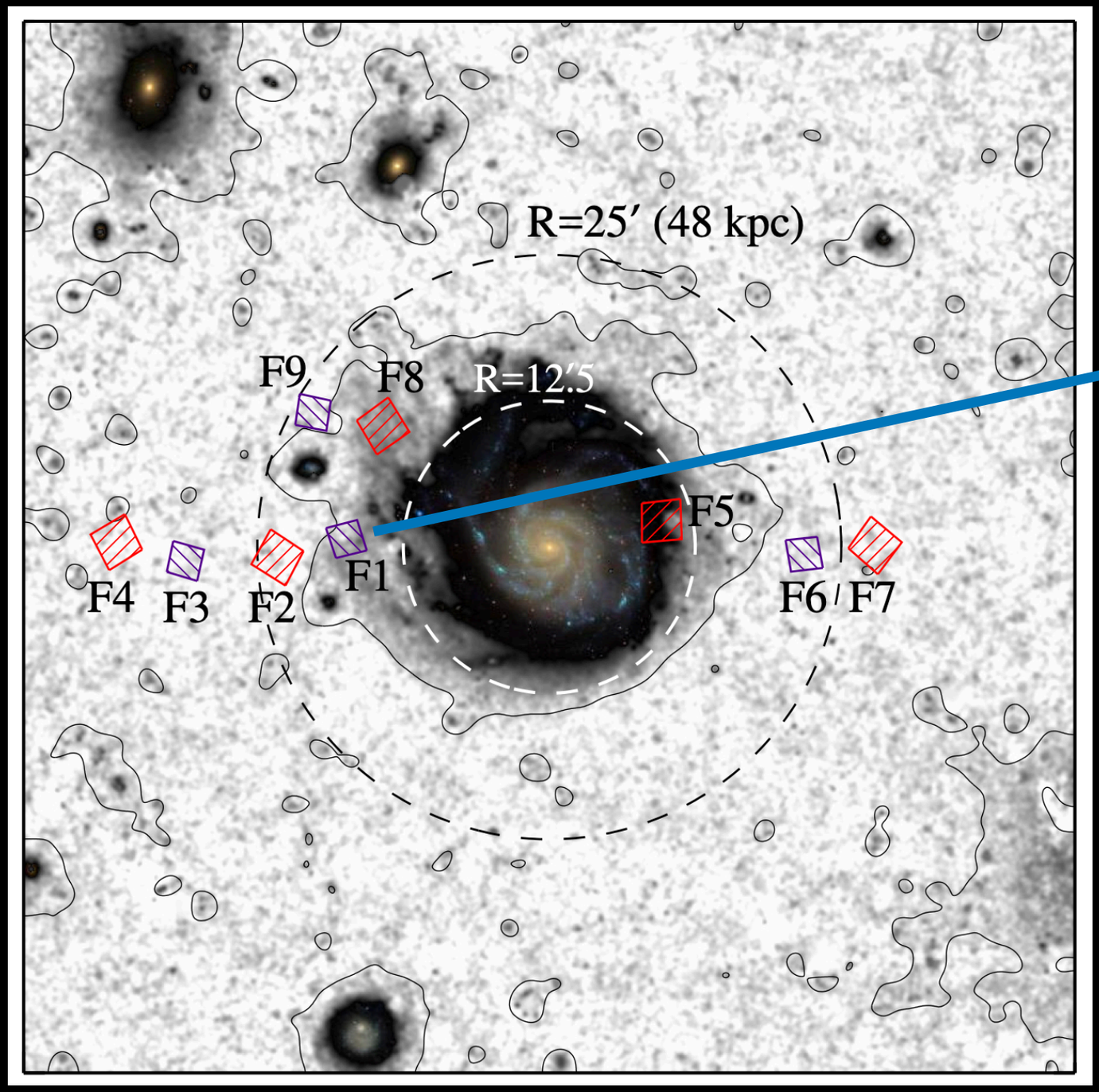
Stars located using IR data only
(Williams et al. 2014)

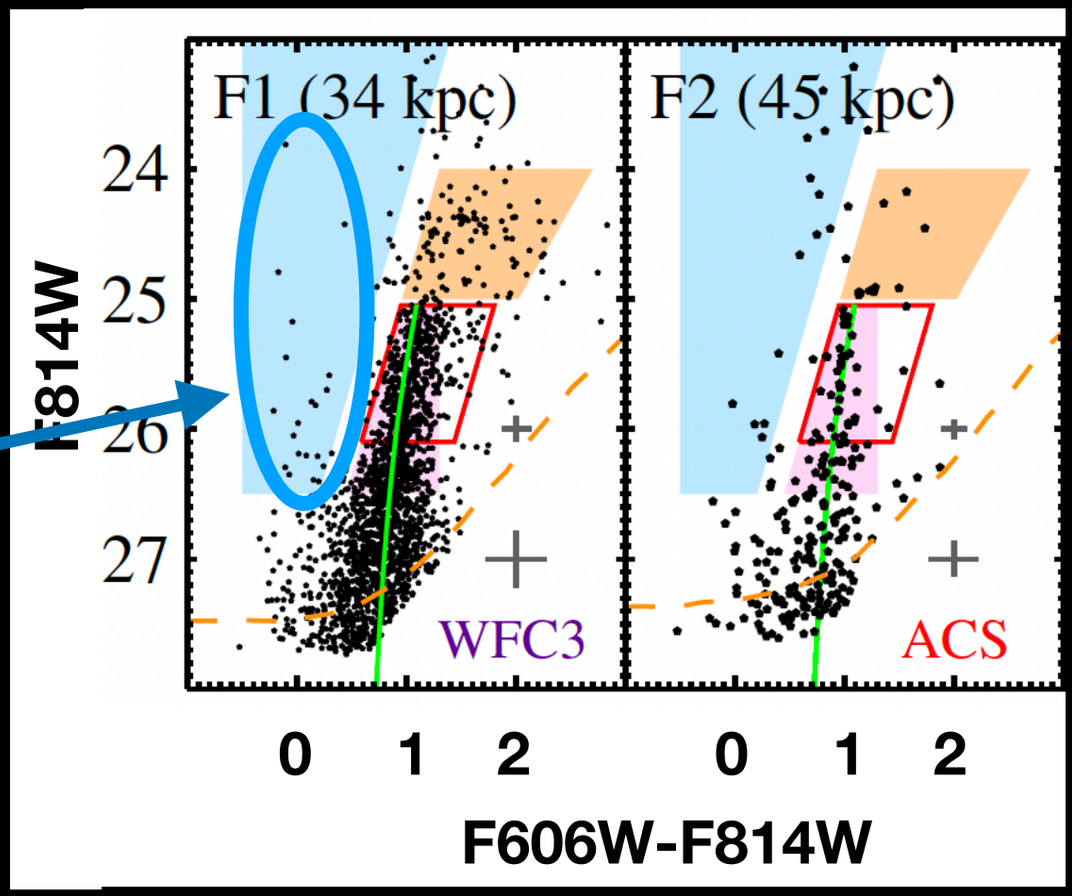
Stars located using all bands

Outer Galaxies with Roman



Currently HST gives glimpses of the outer galaxy

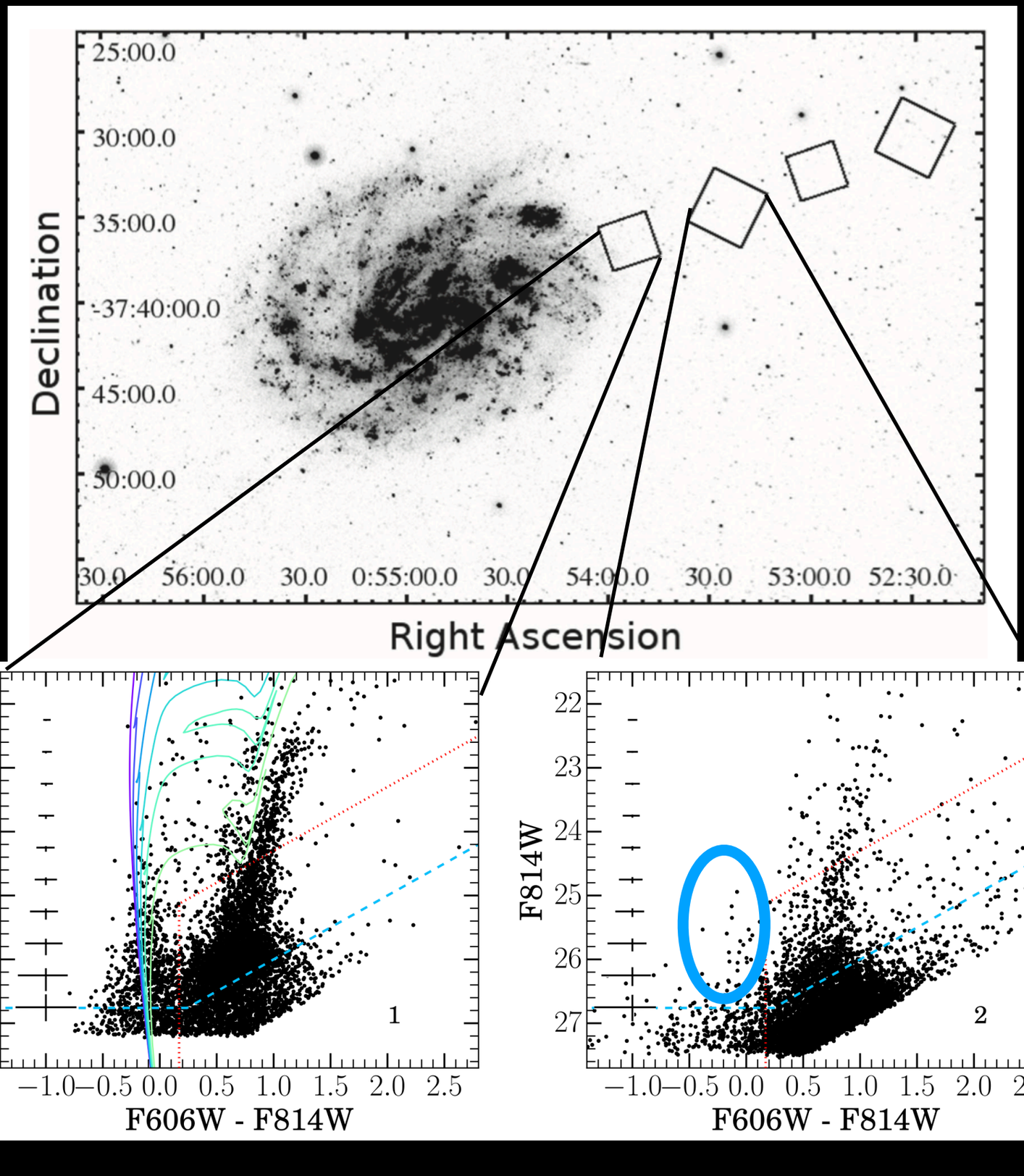




Massive stars are sparse at large radii, no temperature information in red bands

Jang et al. 2020

NGC 300- again more area will help

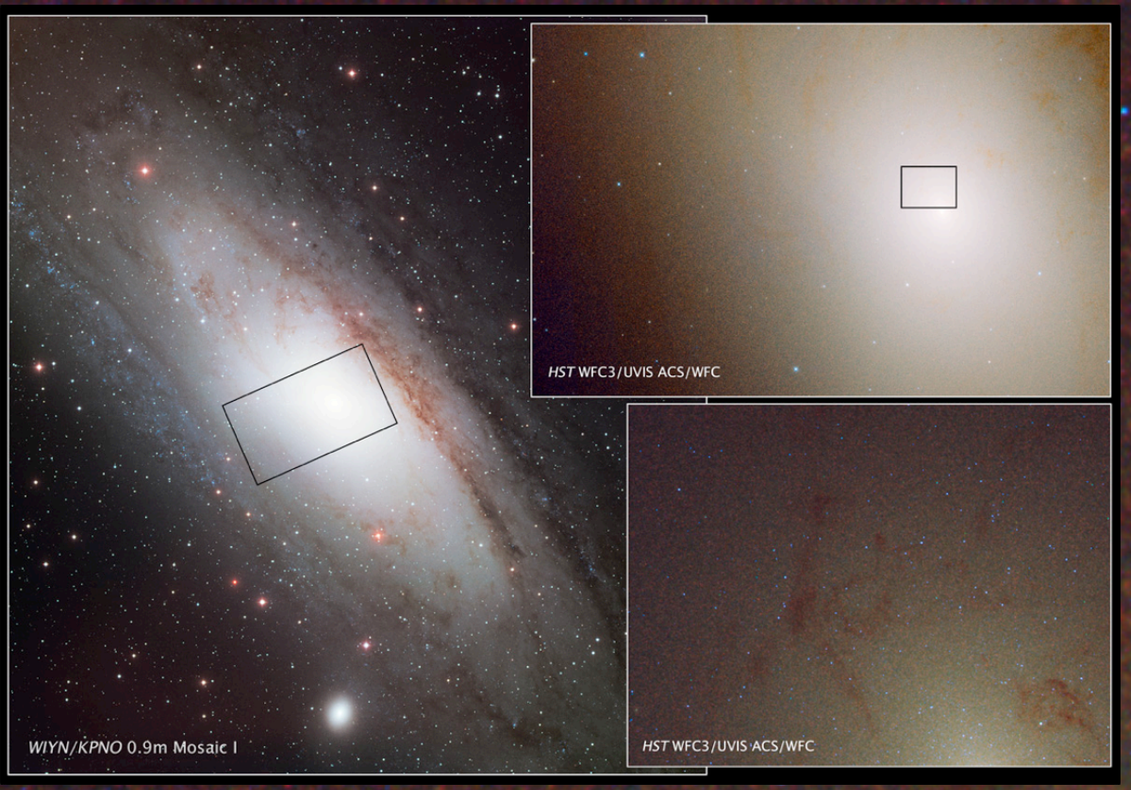


Hillis et al. 2016

Dense Old Populations Show Post-AGB UV

HST Field of View

Galex Team, Caltech, NASA



M31 Bulge UV Partially Resolved into stars

F275W+F336W

F475W

F814W

Rosenfield et al. 2012

Summary

- Roman detects and constrains old stars. Roman+UVEX can provide complementary star formation measures.

- UVEX+Roman can identify and characterize massive stars and young disk stars in areas where UV crowding is low, such as outer disks.

- Potential for UV constraints on dense old populations.

- Worth considering going deeper than the all-sky on nearby galaxy sample