



Mapping Star-Forming Regions in **NGC 2903**

Event Horizon Crew

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NGC 2903

Galaxy :

NGC 2903 is an isolated barred spiral galaxy in the equatorial constellation of Leo, positioned about 1.5° due south of Lambda Leonis. It was discovered by German-born astronomer William Herschel, who cataloged it on November 16, 1784. [Wikipedia](#)

Magnitude: 10.44

Distance to Earth: 30.66 million light years

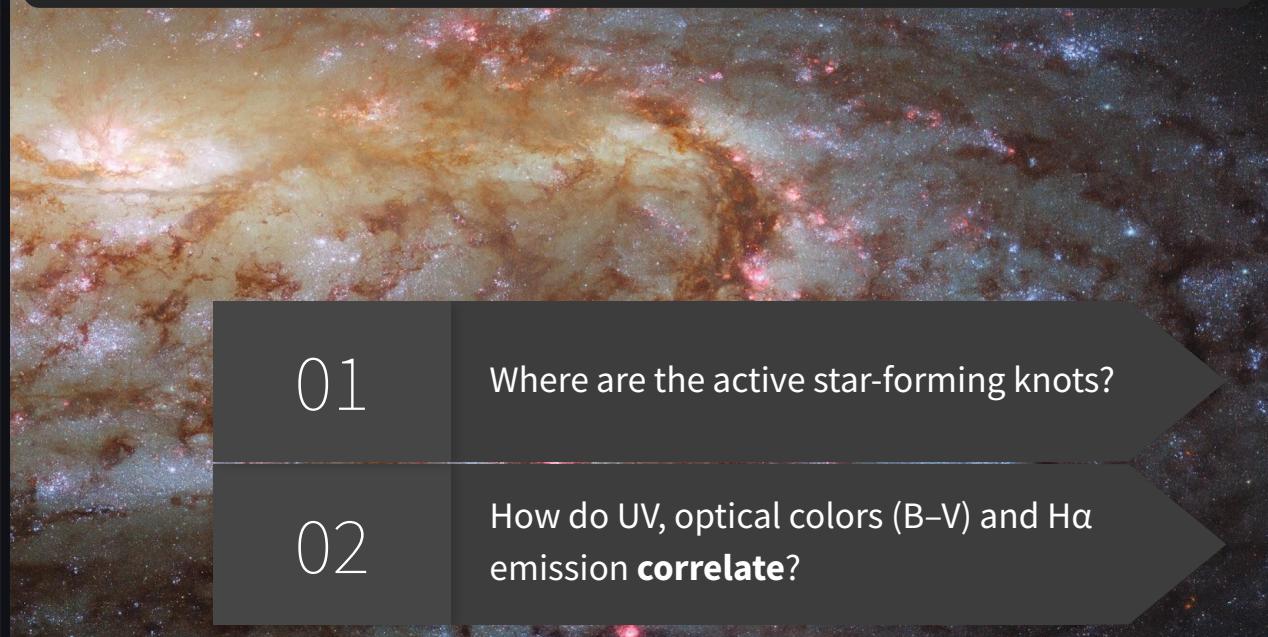
Apparent magnitude (V): 10.44

Constellation: Leo

Absolute magnitude: -21.88

Introduction

nearby barred spiral / rich H II / young stellar populations



01

Where are the active star-forming knots?

02

How do UV, optical colors (B-V) and H α emission **correlate**?

Image Credit

ESA/Hubble & NASA, L. Ho, J. Lee and the PHANGS-HST Team

What is **Broadband Photometry**?

Measuring an object's brightness through wide wavelength filters to study its **properties**.

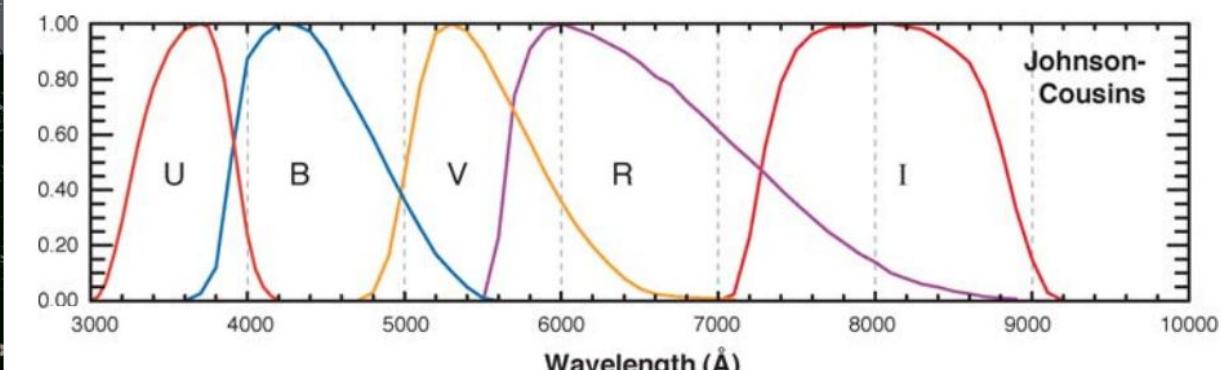
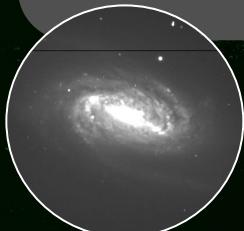


Image Credit
Bessell (2005), Jeff Khim

Data Sources

BVR frames

Imaged using Mont4K CCD
(61" Kuiper Telescope)

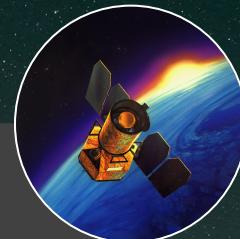


Imaging



GALEX UV

(NUV/FUV) cutouts



Spectro/photometry

H α flux catalog

1. Multiwavelength study of the star-formation in the bar of NGC 2903 (Popping et al. 2010)
SIMG. "NGC 2903 in H-alpha and Continuum Light."
- 2.

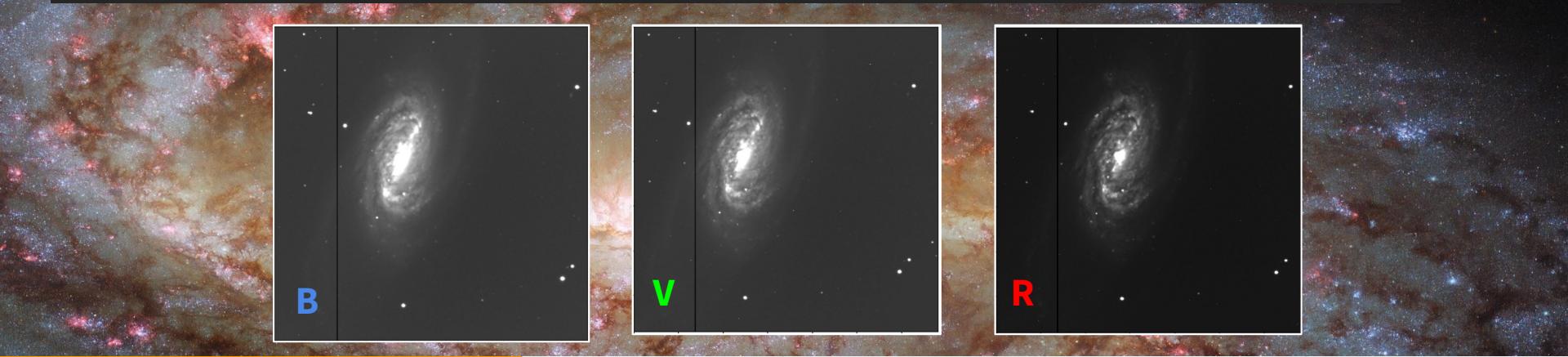


DSS Survey

+ APASS9 field stars (via VizieR), DSS2 background + SIMBAD overlay

Image Credit
Jeff Khim, NASA/JPL

/1/ Bias Subtraction & /2/ Flat-Fielding



1

Bias subtraction

Remove detector noise.

2

Flat-fielding

Correct for pixel sensitivity and optical effects.

3

Cosmic-ray removal and bad column interpolation

Eliminate transient particle hits on the CCD.

4

Sky/2D-bg subtraction

Subtract background light for cleaner sources.

5

Image-based alignment & stacking

Frames aligned using sub-pixel cross-correlation

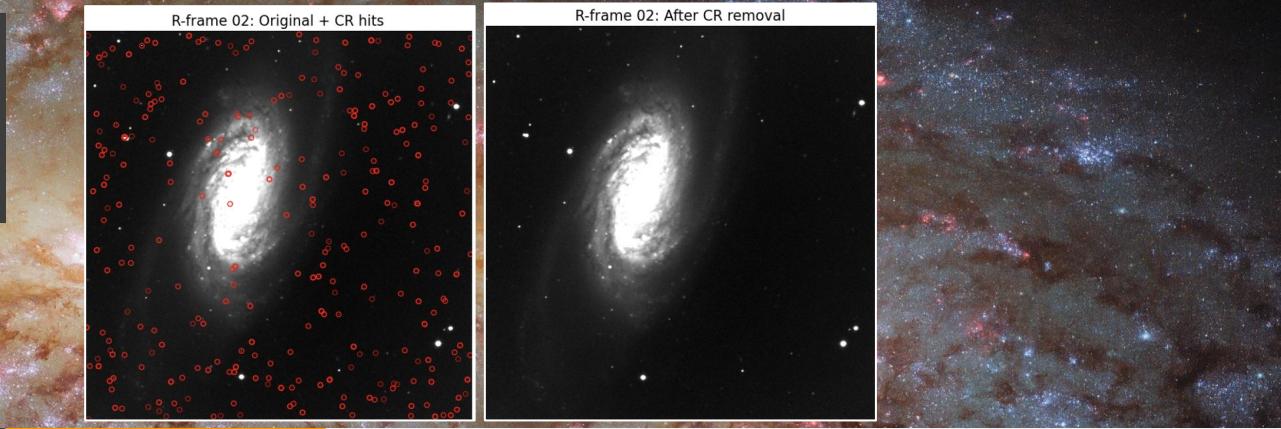
6

Photometric calibration (ADU→mag)

Convert raw counts to standard magnitudes.

/3/ Cosmic-ray Cleaning & Destriping

- L.A.Cosmic → clean hot pixels
- Bad column correction



1

Bias & dark subtraction

Remove detector noise and thermal signal.

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Frames aligned using sub-pixel cross-correlation

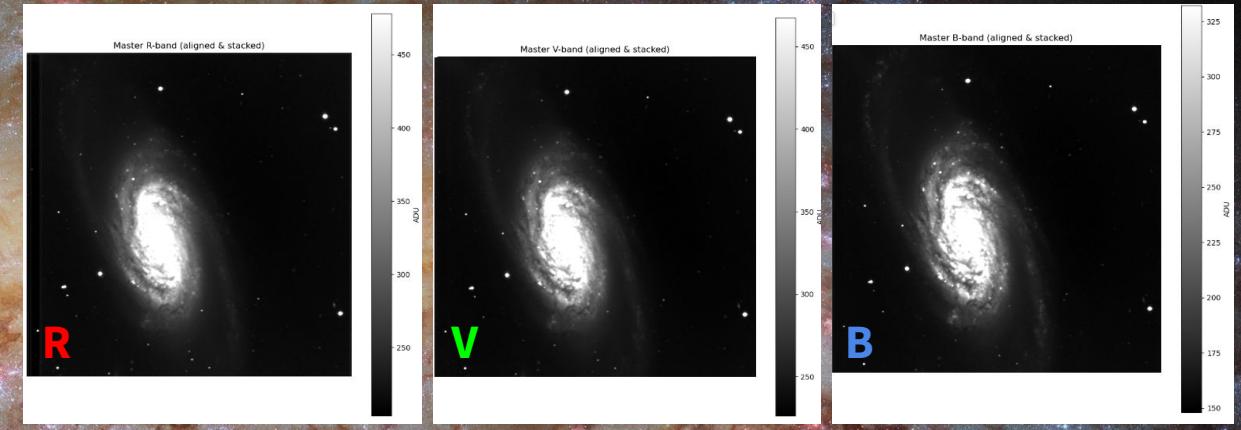
6

Photometric calibration (ADU→mag)

Convert raw counts to standard magnitudes.

/4/ Sky Subtraction & /5/ Stacking

- 2D median-filter sky model → subtract large-scale gradients
- Sub-pixel alignment (phase cross-corr) to common WCS
- Median-stack **R/V/B** → master images



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/6/ Photometric Calibration

- Use standard magnitude value from dss survey
- Measure instrumental mags via aperture photometry
- Compute zero-points
- Validate by overplotting calib stars on master-V



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Image-based alignment & stacking

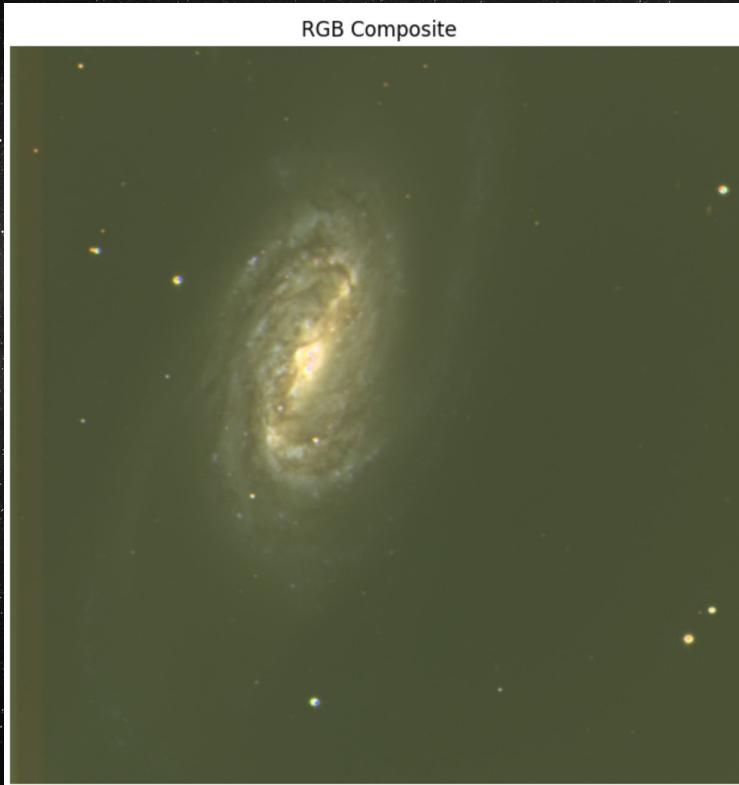
Frames aligned using sub-pixel cross-correlation

6

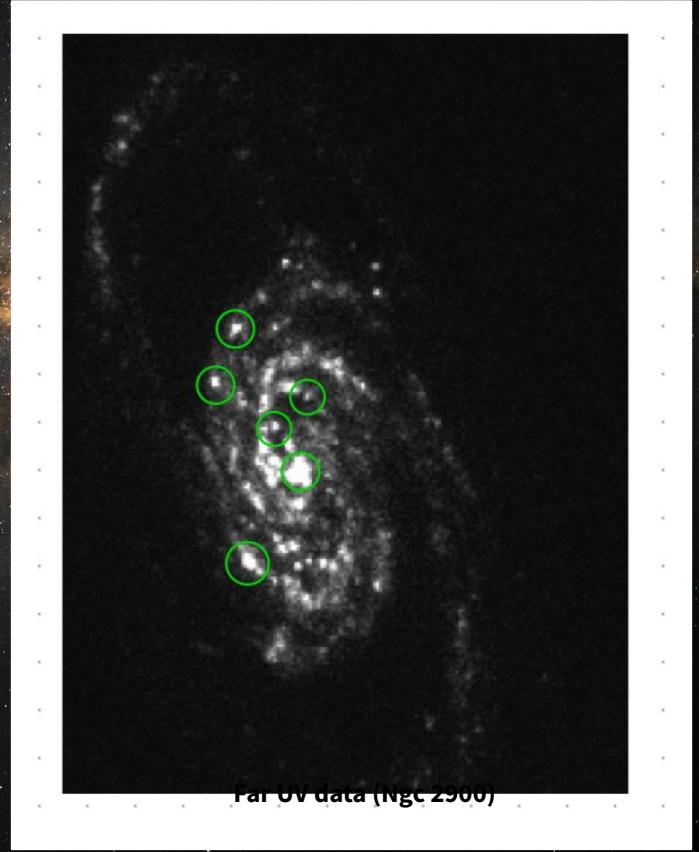
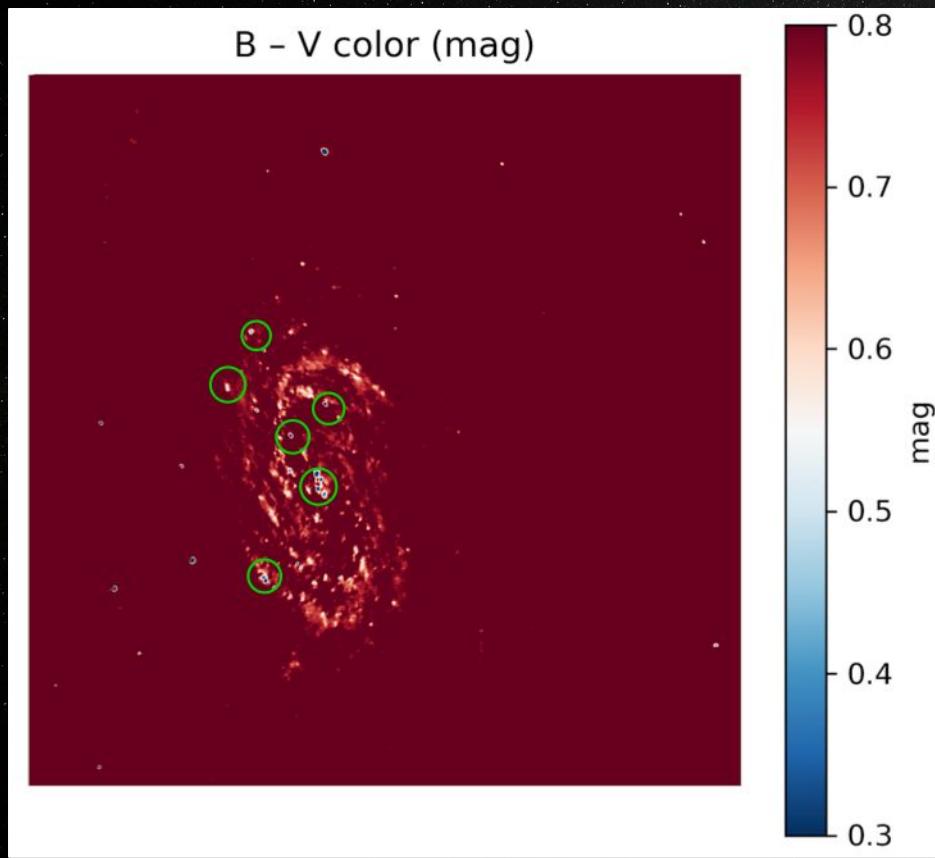
Photometric calibration (ADU→mag)

Convert raw counts to standard magnitudes.

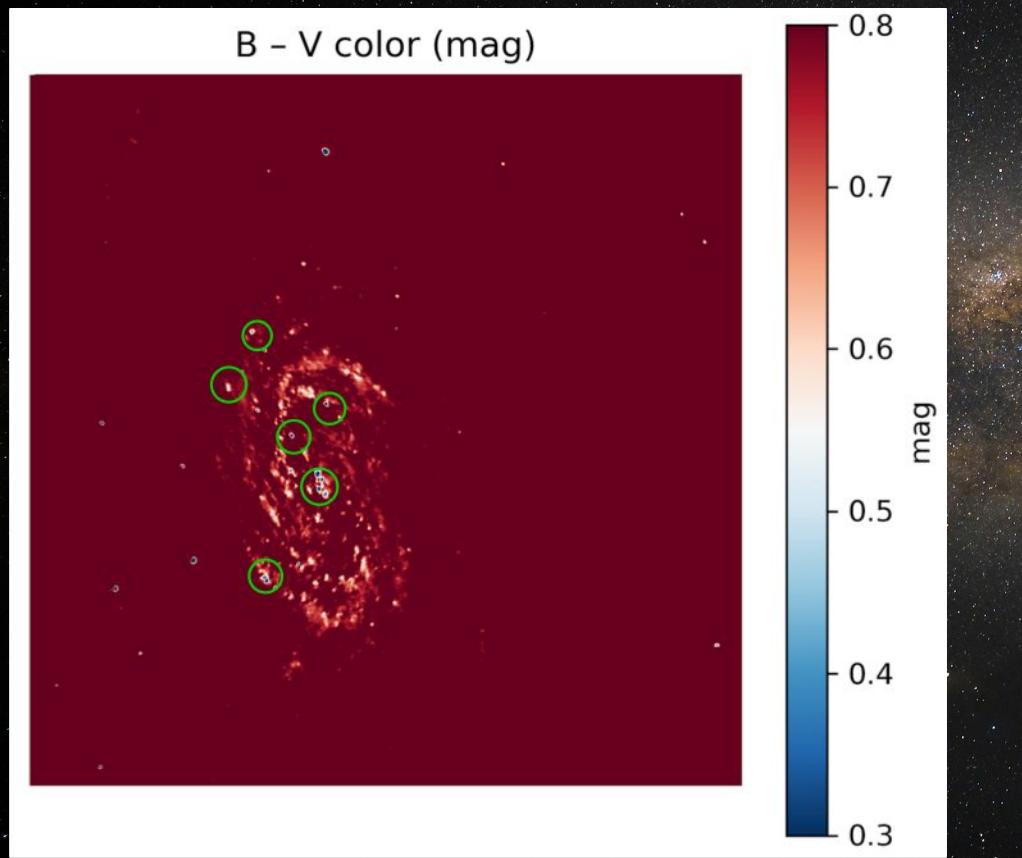
RGB Composite using `make_lupton_rgb` function in
`astropy.visualization` module



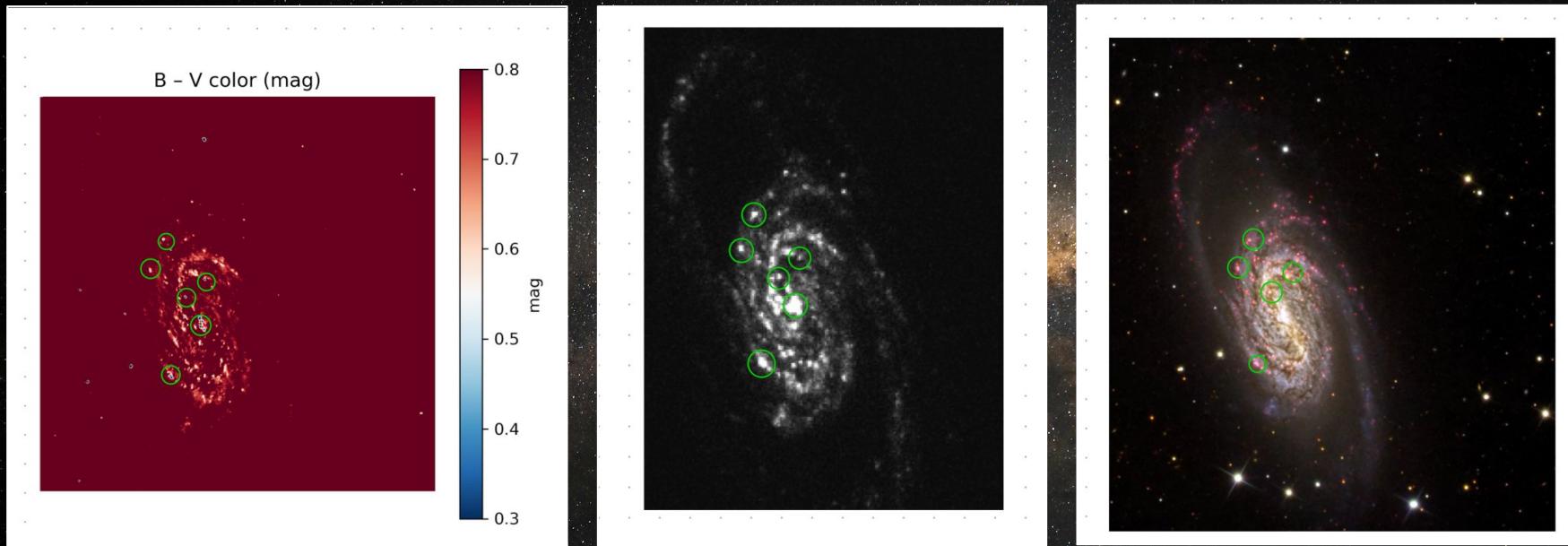
Color Index Map (B-V)



H α Catalog Matching



Multi-wavelength Synthesis



Multi-wavelength overlay in DS9

- Loaded calibrated $B - V$, UV and $H\alpha$ frames in synchronized frames.

Region selection: marked pixels where:

- $B - V < 0.2$ mag (optically blue)
- UV emission in the top 10 percentile (young O/B stars)
- Coincident $H\alpha$ peaks (ionized gas)

Candidate confirmation

- Only regions showing **all three** diagnostics were flagged.
- Exported region coordinates for later photometry.

Interpretation of *tracers*

UV

very young, unobscured stars

B-V

stellar ages & dust reddening

H α

ionized gas around massive
OB stars

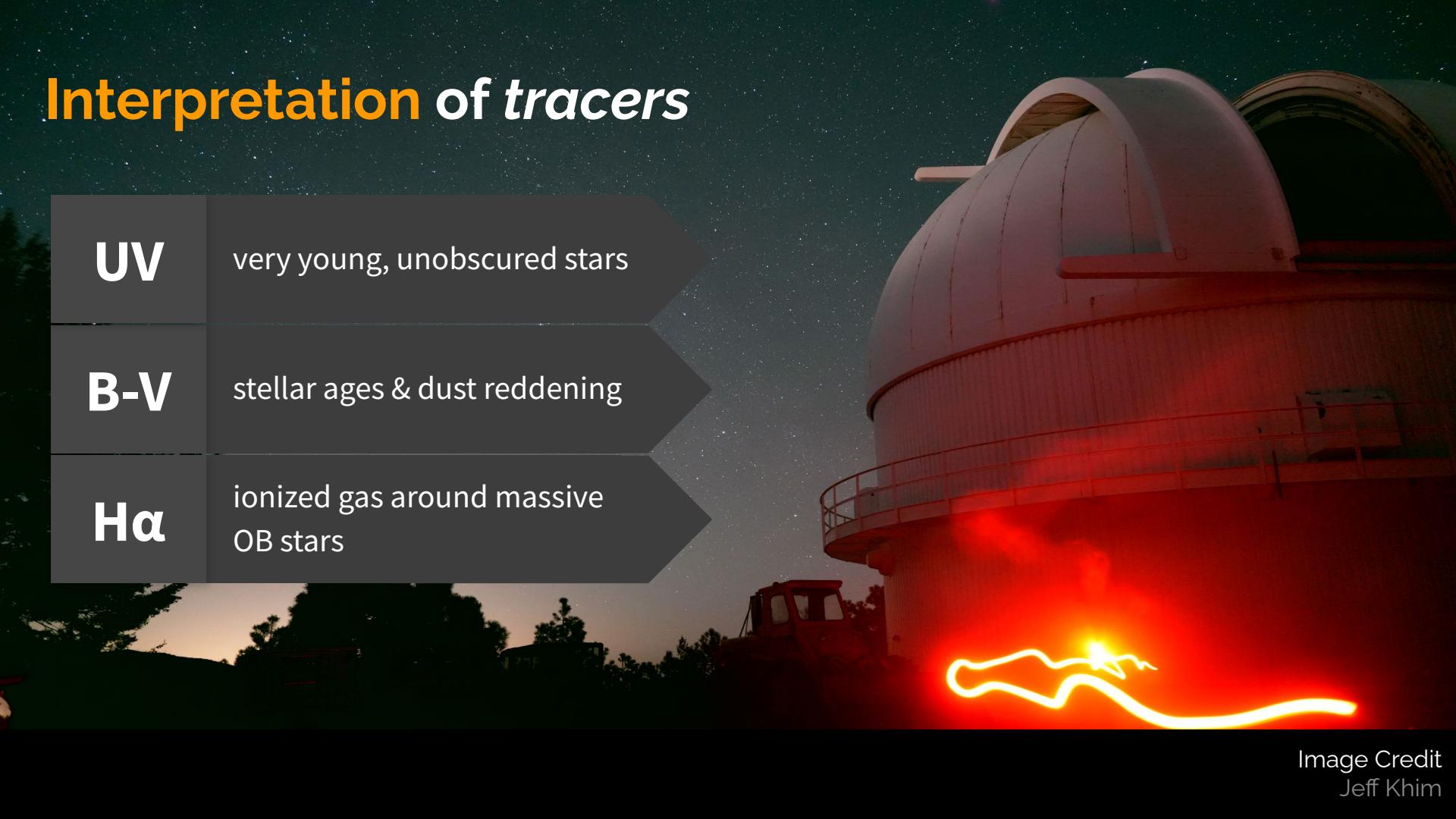


Image Credit
Jeff Khim

Interpretation of results

Outer Regions

Starburst activity due to spiral arms and density waves

Central Regions

Bars would cause gas to funnel in and enhance star formation

Circum-nuclear ring

Most prominent star forming region.

Next steps

- Derive SFR surface density maps
- Compare to CO/molecular gas
- Extend to other galaxies

Image Credit
Jeff Khim



Conclusion

Outer Regions

Starburst activity due to spiral arms and density waves

Central Regions

Bars would cause gas to funnel in and enhance star formation

H α

ionized gas around massive OB stars

We thank Dr. Zaritsky, Jeff Khim, and Dr. Green for their valuable support on this project. We also acknowledge the data sources and references that contributed to our work.