

Probing the Hubble Constant with JWST: Updated Time-Delay Measurements from the Triply-Imaged Type Ia Supernova SN H0pe

Aadya Agrawal, UIUC/NSF Simons SkAI Institute
AAS 247 Special Session, January 8th, 2026

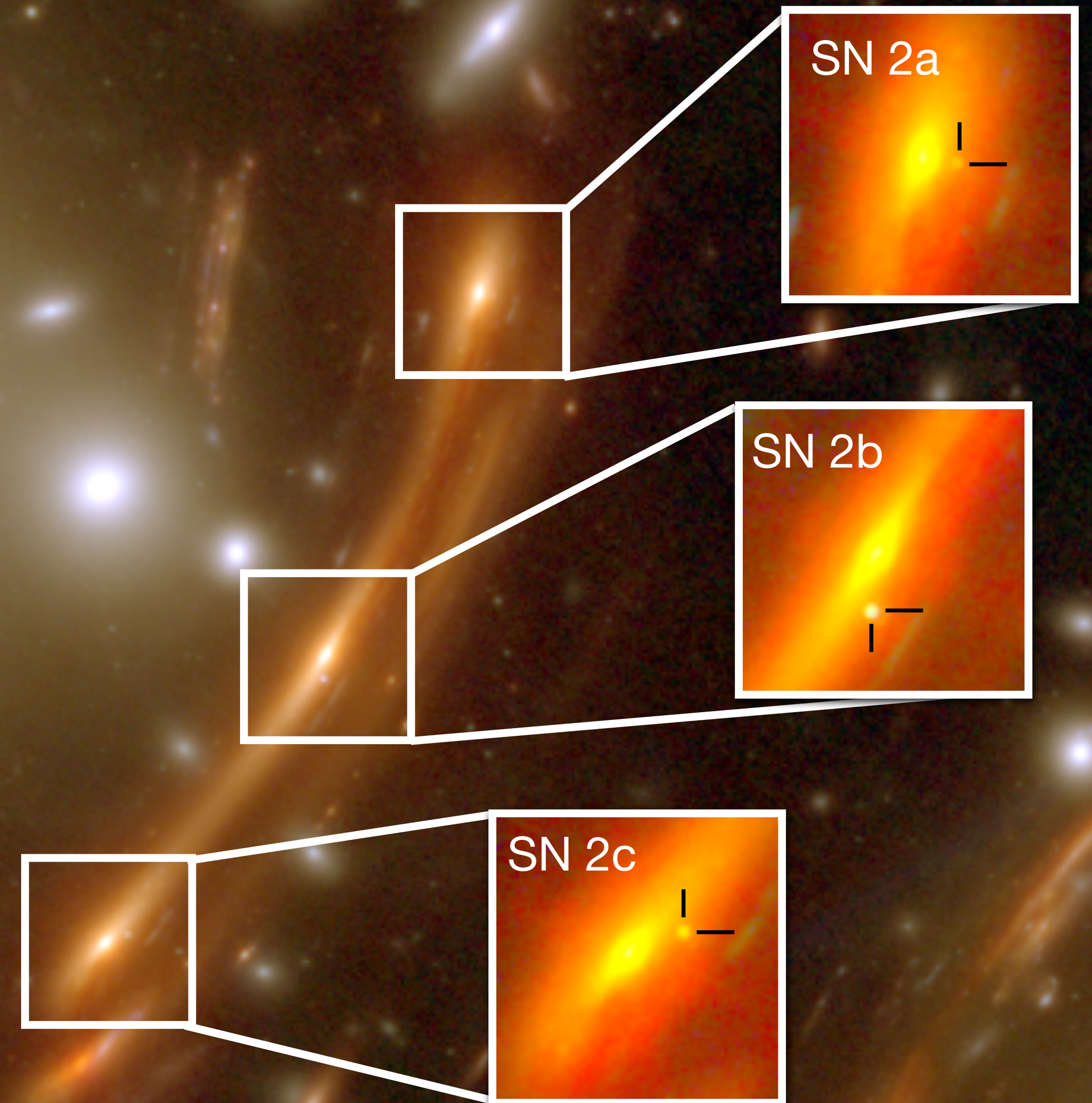
SN H0pe

A Triply-Lensed SN Ia

- In Arc 2 of PLCK G165.7+67.0
- $z = 1.7834 \pm 0.0005$
- First H_0 measurement from a gISN Ia!
(Pascale et al 2025)

$$H_0 = 75.7^{+8.1}_{-5.5} \text{ km s}^{-1} \text{ Mpc}^{-1}$$

- Successful template obtained in JWST Cycle 3 program in May 25 (PID: 4744, PI: Frye)



Why do we need difference imaging?

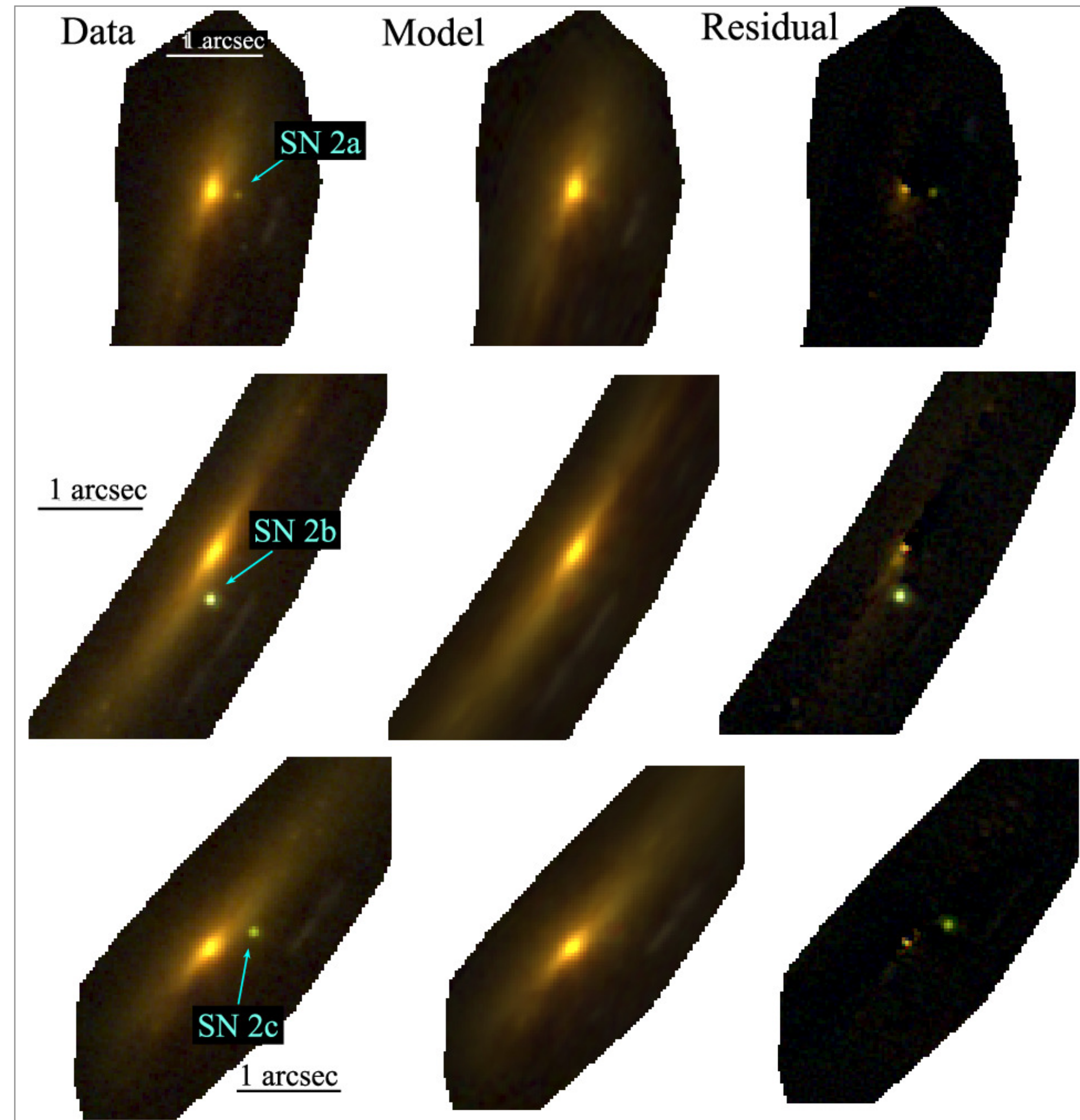
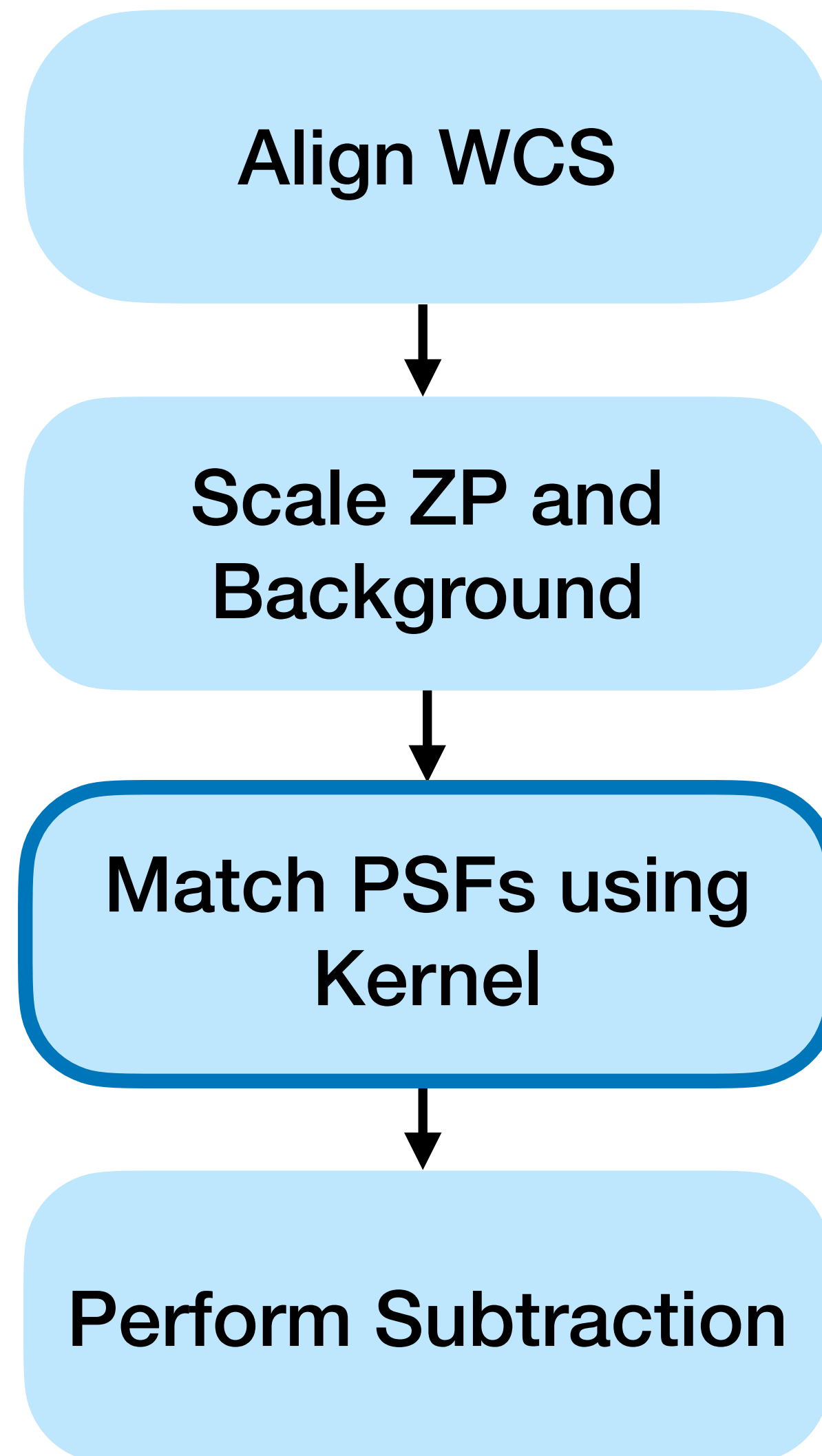


Figure 3 of Pierel+24

Typically Difference Imaging Techniques



FREE ARTICLE

A Method for Optimal Image Subtraction

C. Alard and Robert H. Lupton

© 1998. The American Astronomical Society. All rights reserved. Printed in U.S.A.

[The Astrophysical Journal](#), [Volume 503](#), [Number 1](#)

Citation C. Alard and Robert H. Lupton 1998 *ApJ* 503 325

DOI 10.1086/305984



FREE ARTICLE

PROPER IMAGE SUBTRACTION—OPTIMAL TRANSIENT DETECTION, PHOTOMETRY, AND HYPOTHESIS TESTING

Barak Zackay, Eran O. Ofek, and Avishay Gal-Yam

Published 2016 October 4 • © 2016. The American Astronomical Society. All rights reserved.

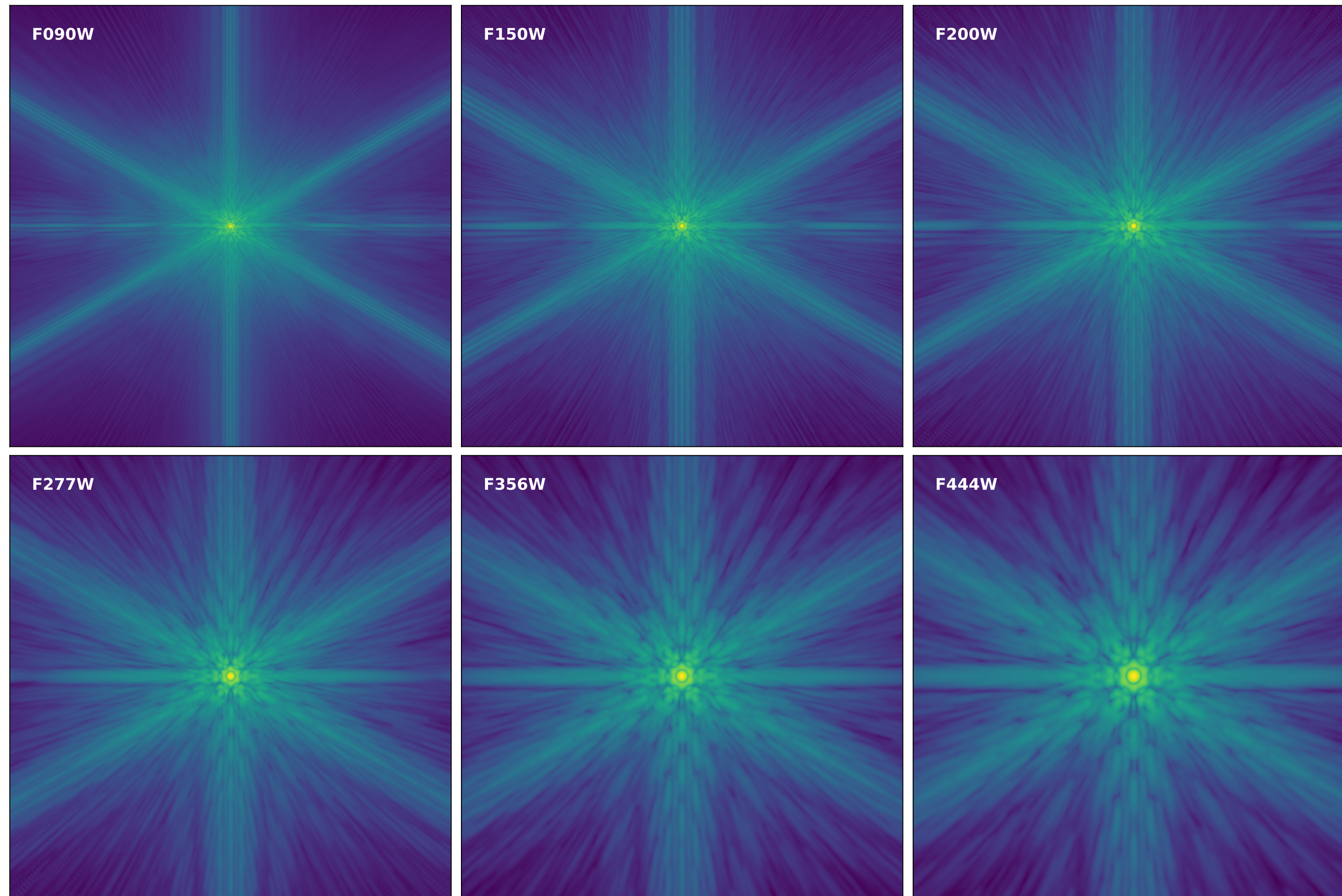
[The Astrophysical Journal](#), [Volume 830](#), [Number 1](#)

Citation Barak Zackay *et al* 2016 *ApJ* 830 27

DOI 10.3847/0004-637X/830/1/27

PyZOGY

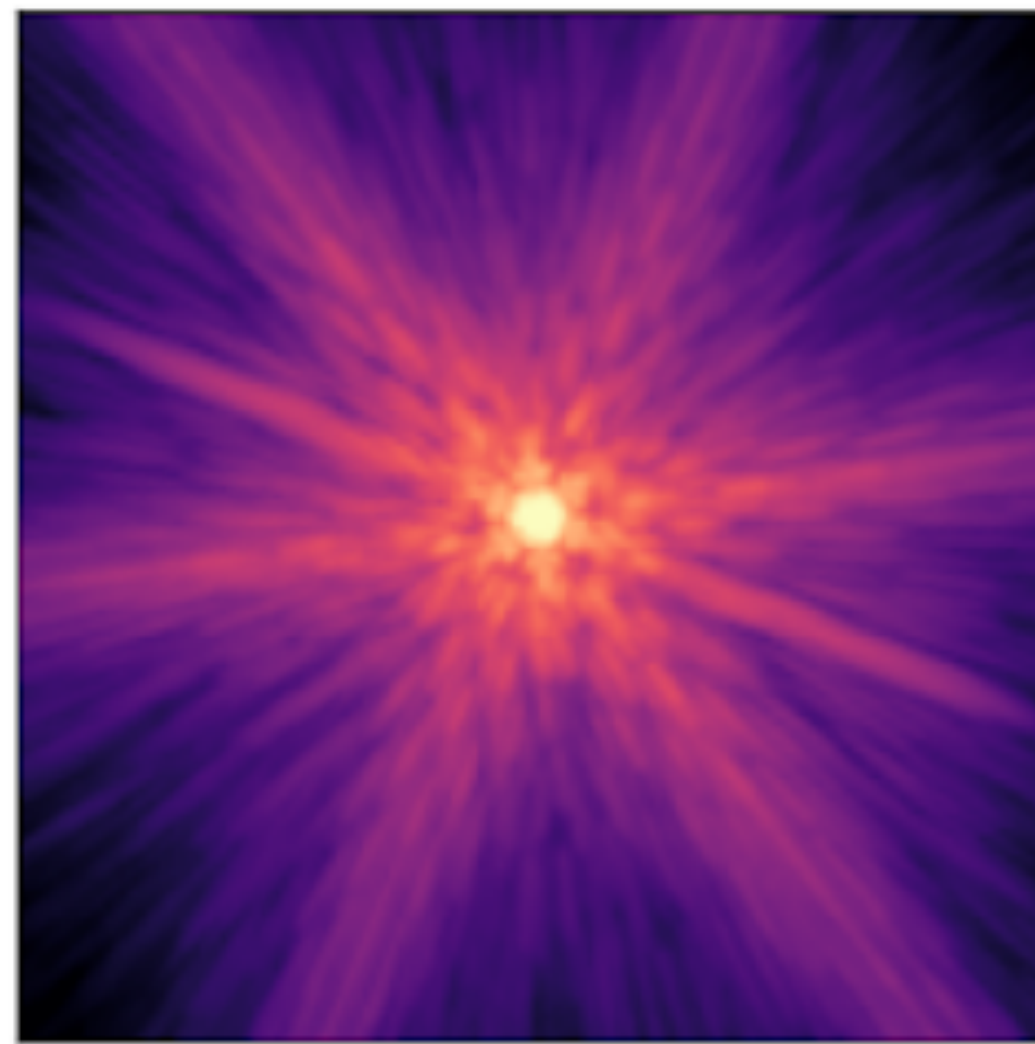
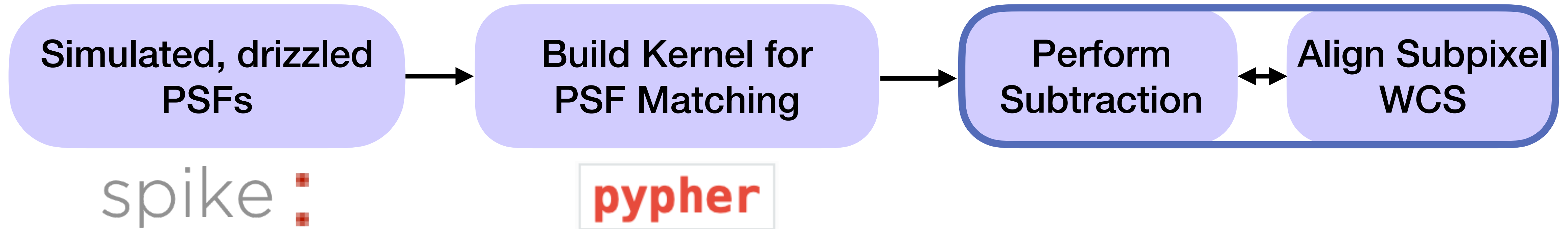
...Don't work for SN H0pe



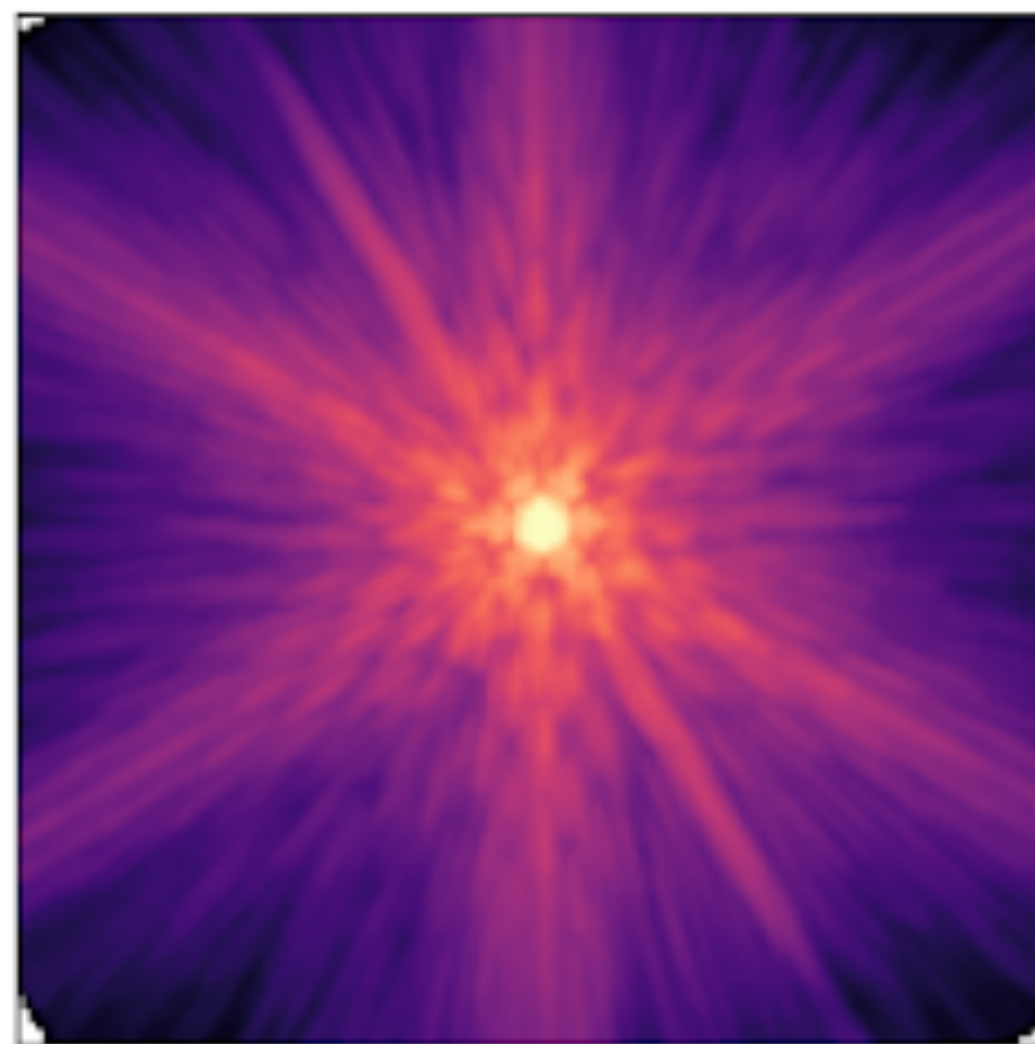
Credits: STPSF, JDox

- JWST PSF is complex and complicated further due to varying PA between epochs.
 - G165 field is sparse with no stars near the SN host!
- ➡ Typical methods can't match the PSF well!

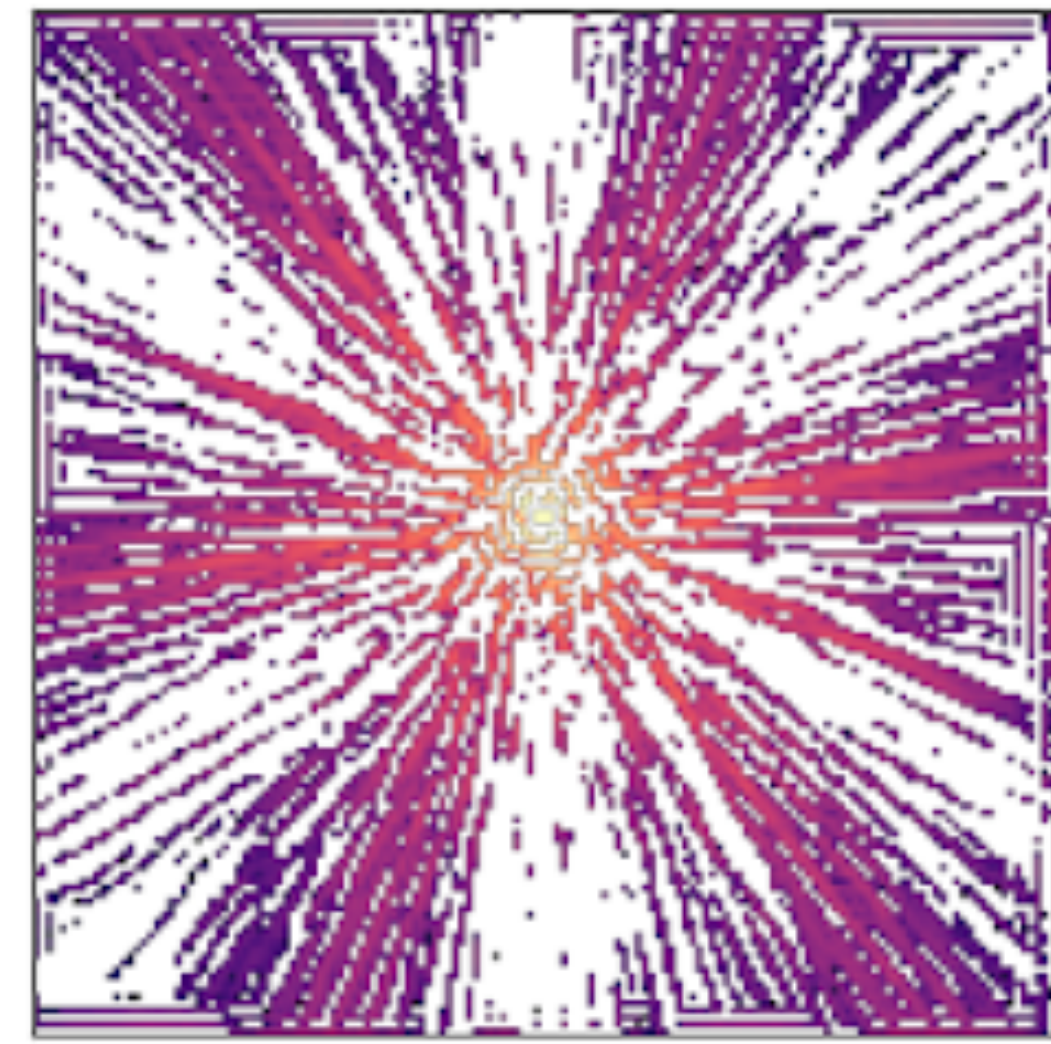
Solution: Simulated PSFs to build Kernel!



Reference

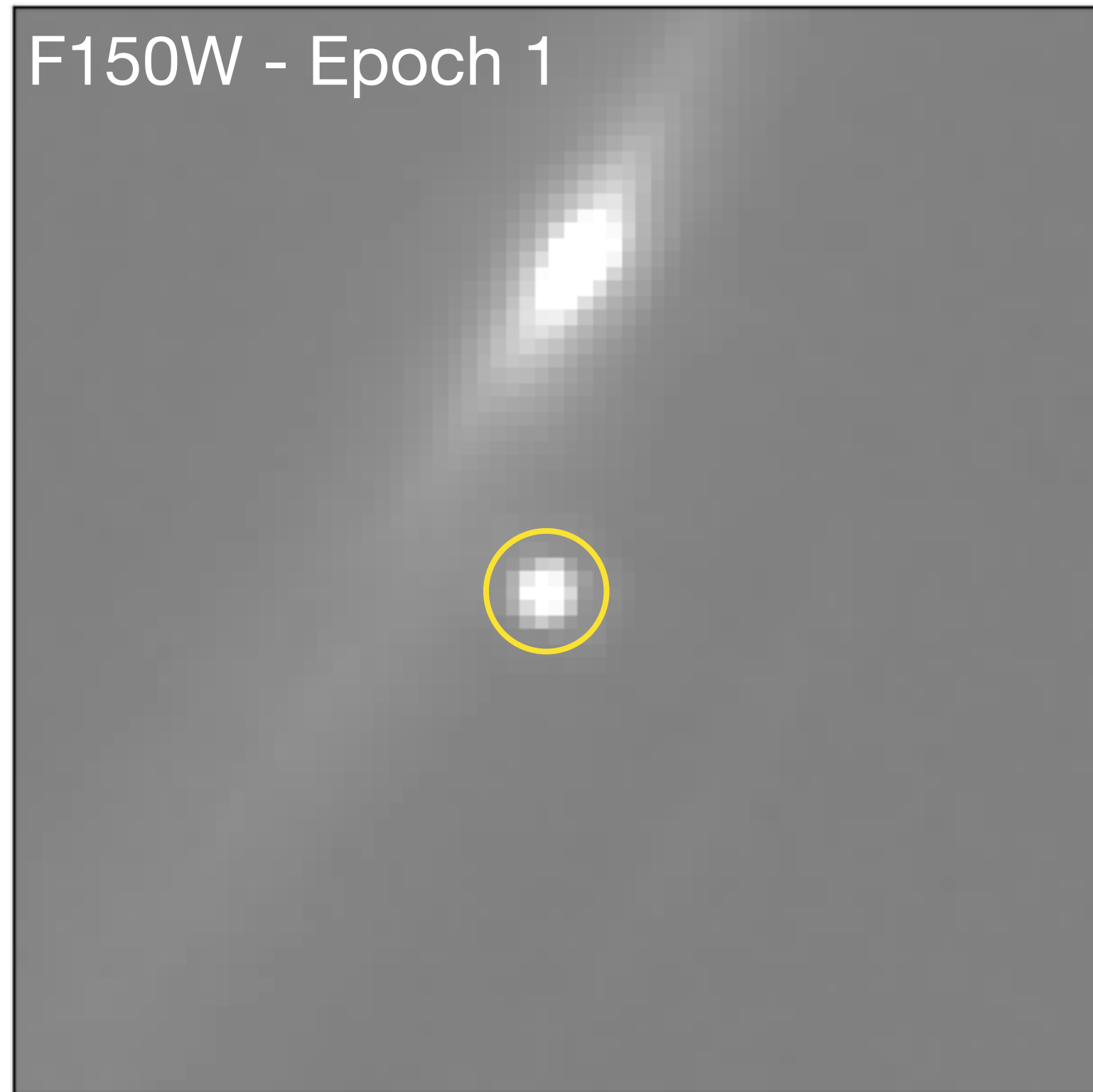


Science

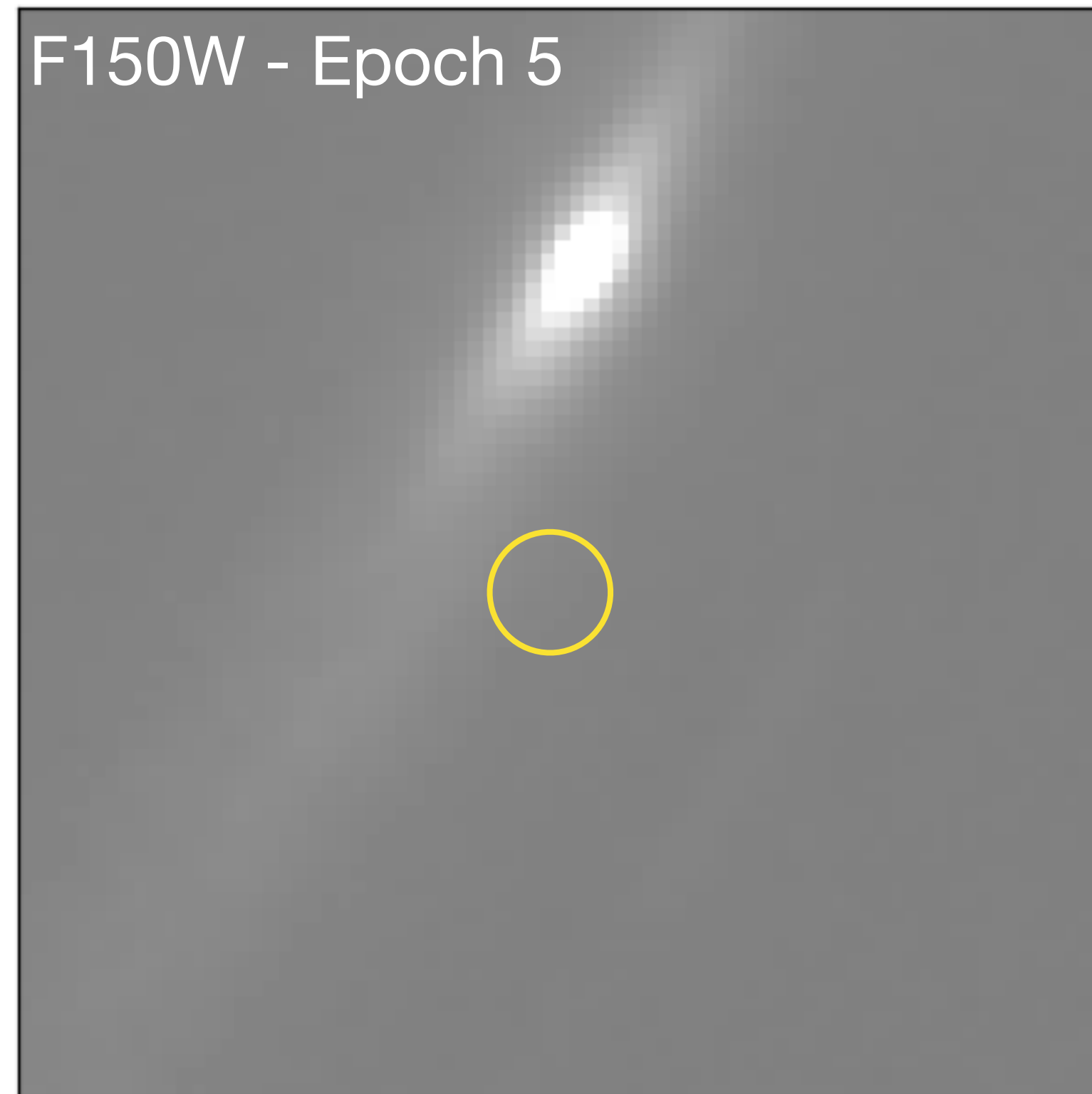


Convolution Kernel

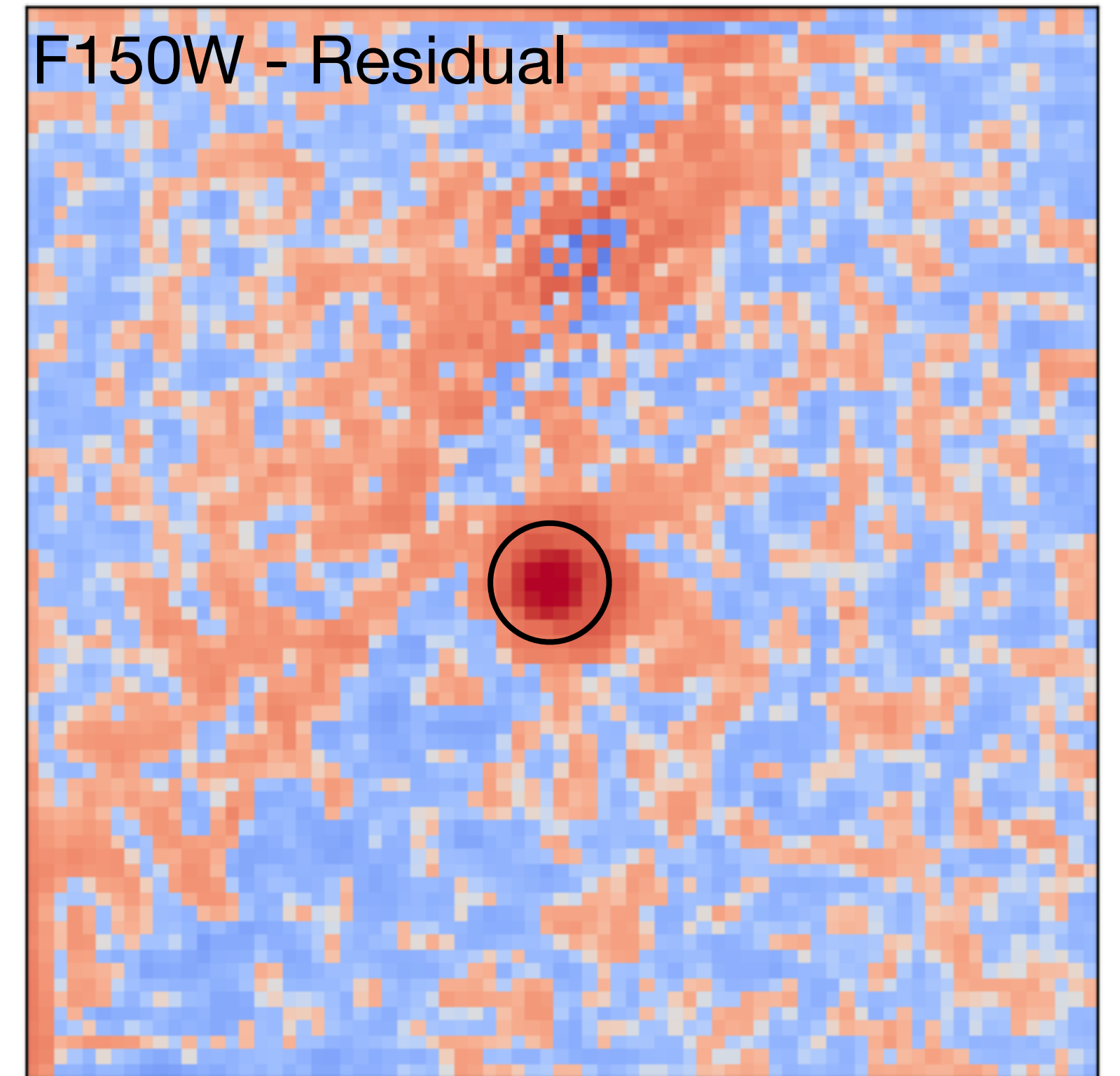
Preliminary Results



SCIENCE IMAGE

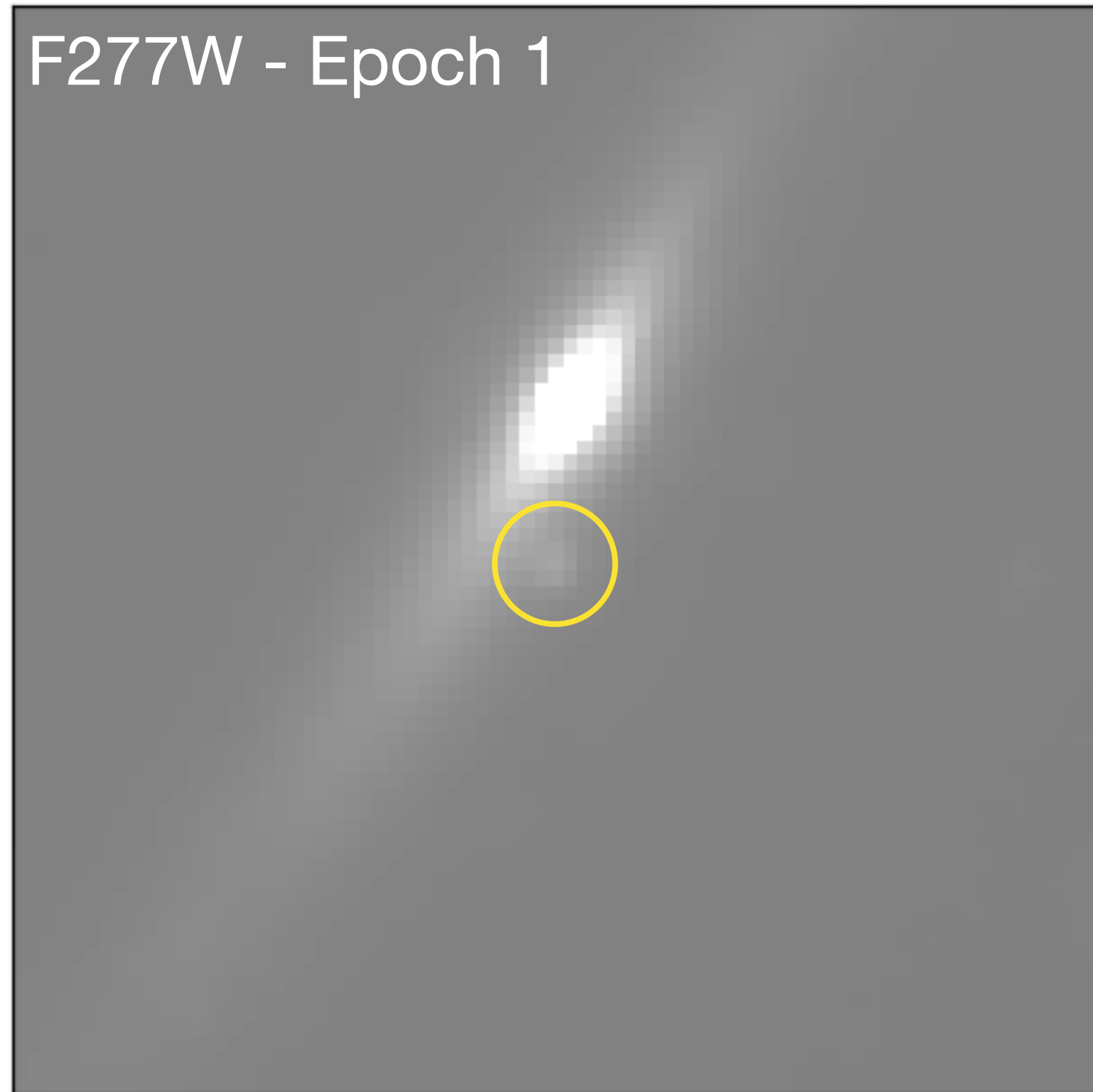


REFERENCE IMAGE

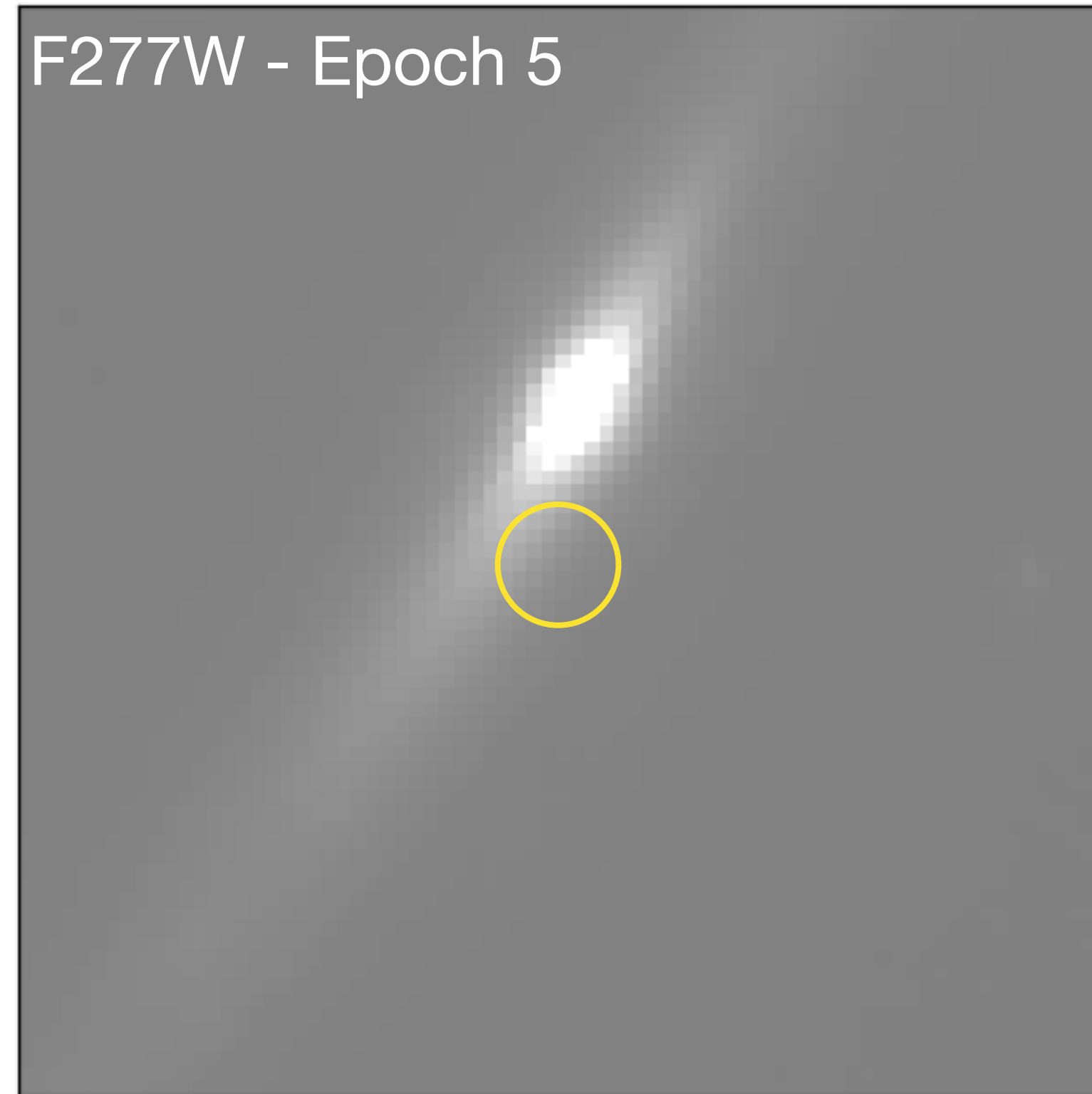


RESIDUAL

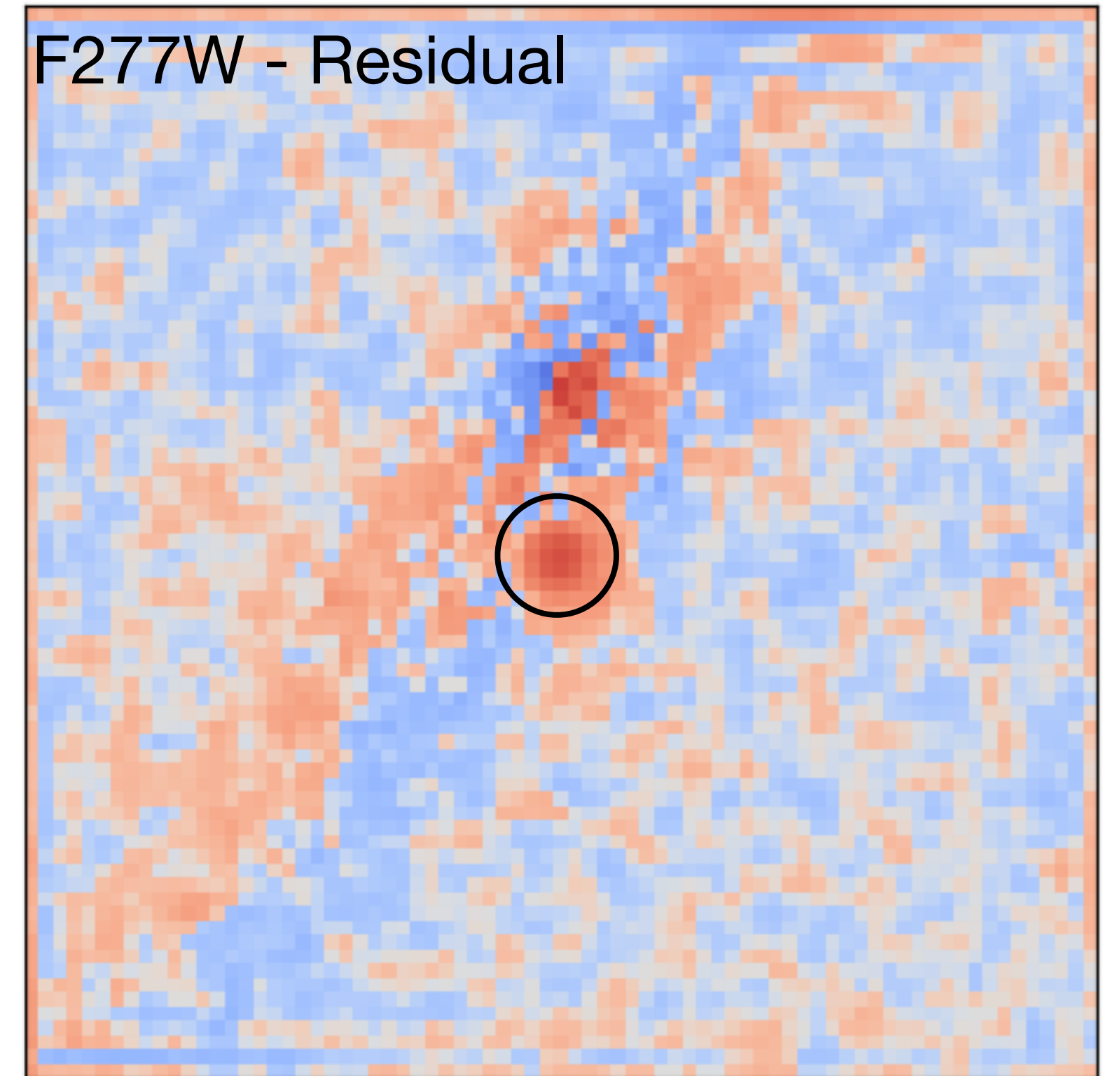
Preliminary Results



SCIENCE IMAGE

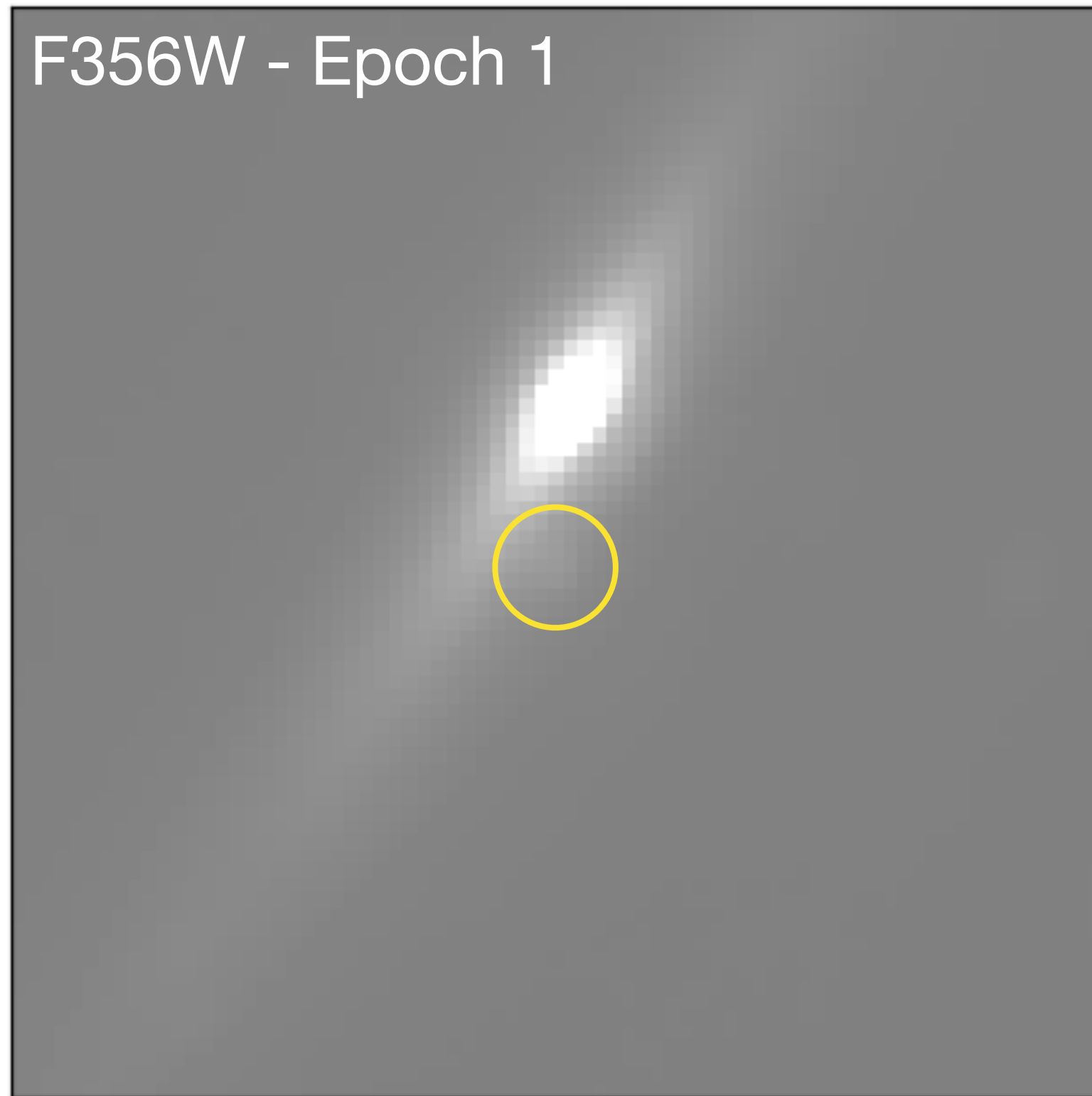


REFERENCE IMAGE



RESIDUAL

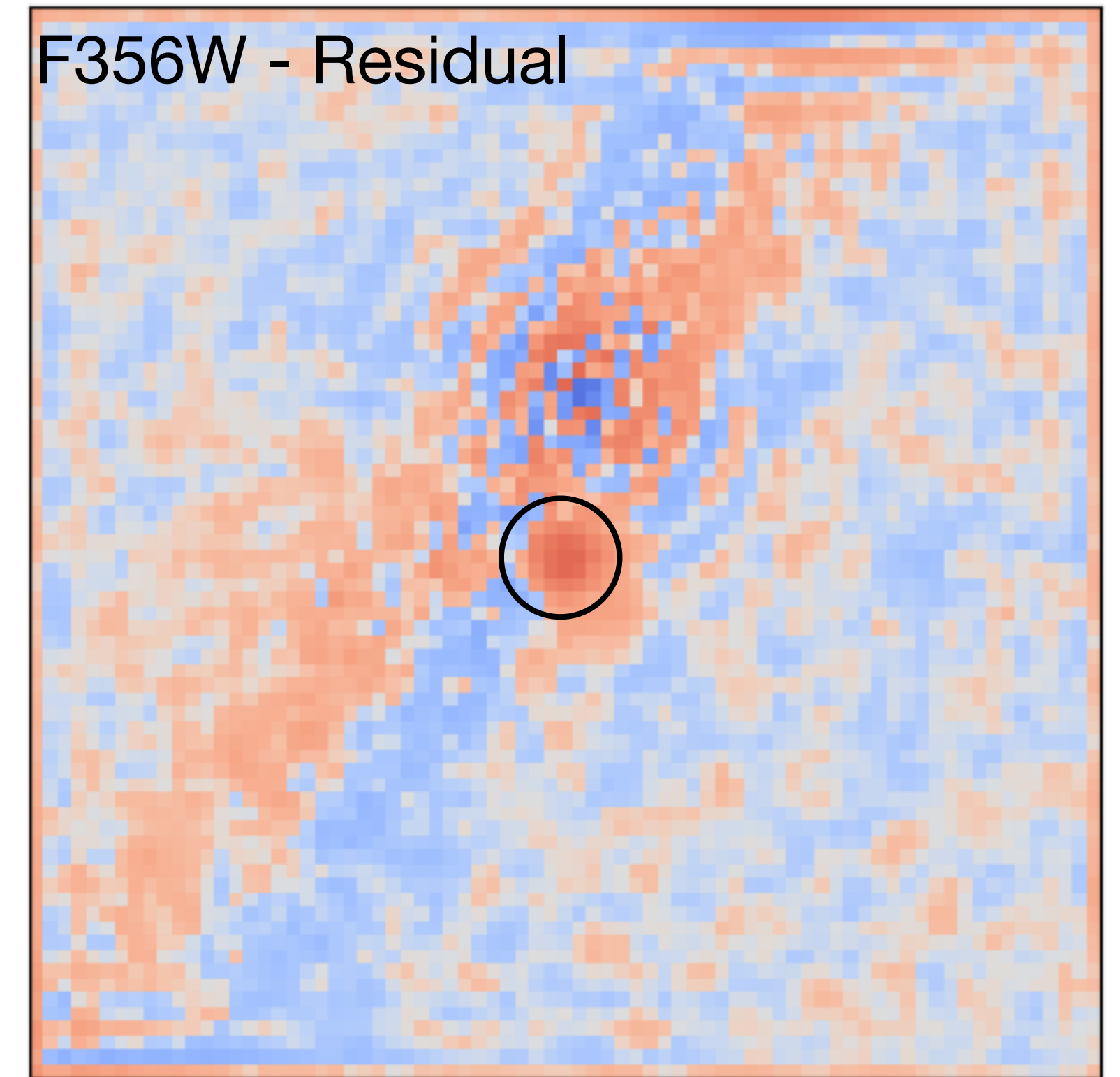
Preliminary Results



SCIENCE IMAGE

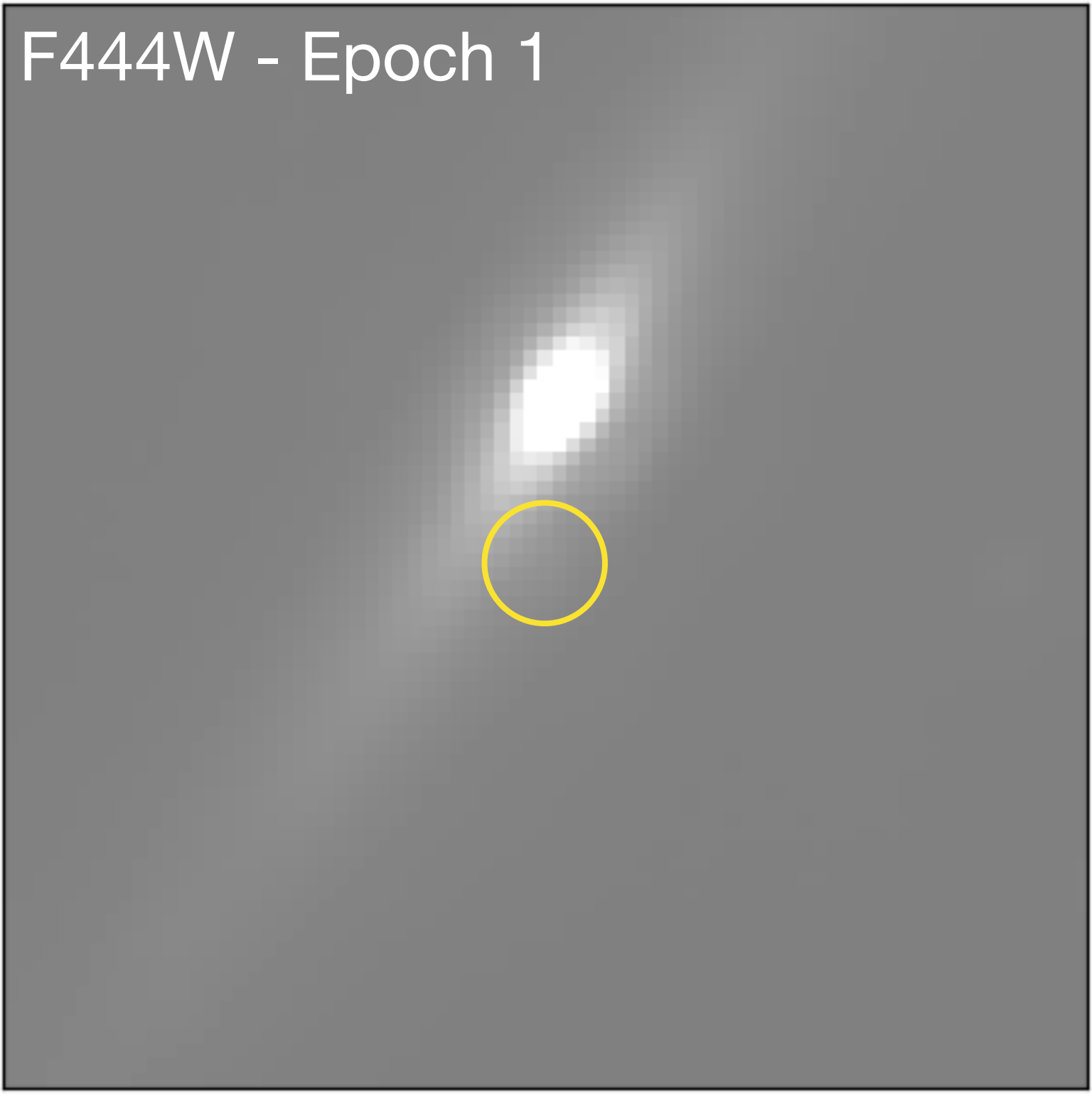


REFERENCE IMAGE

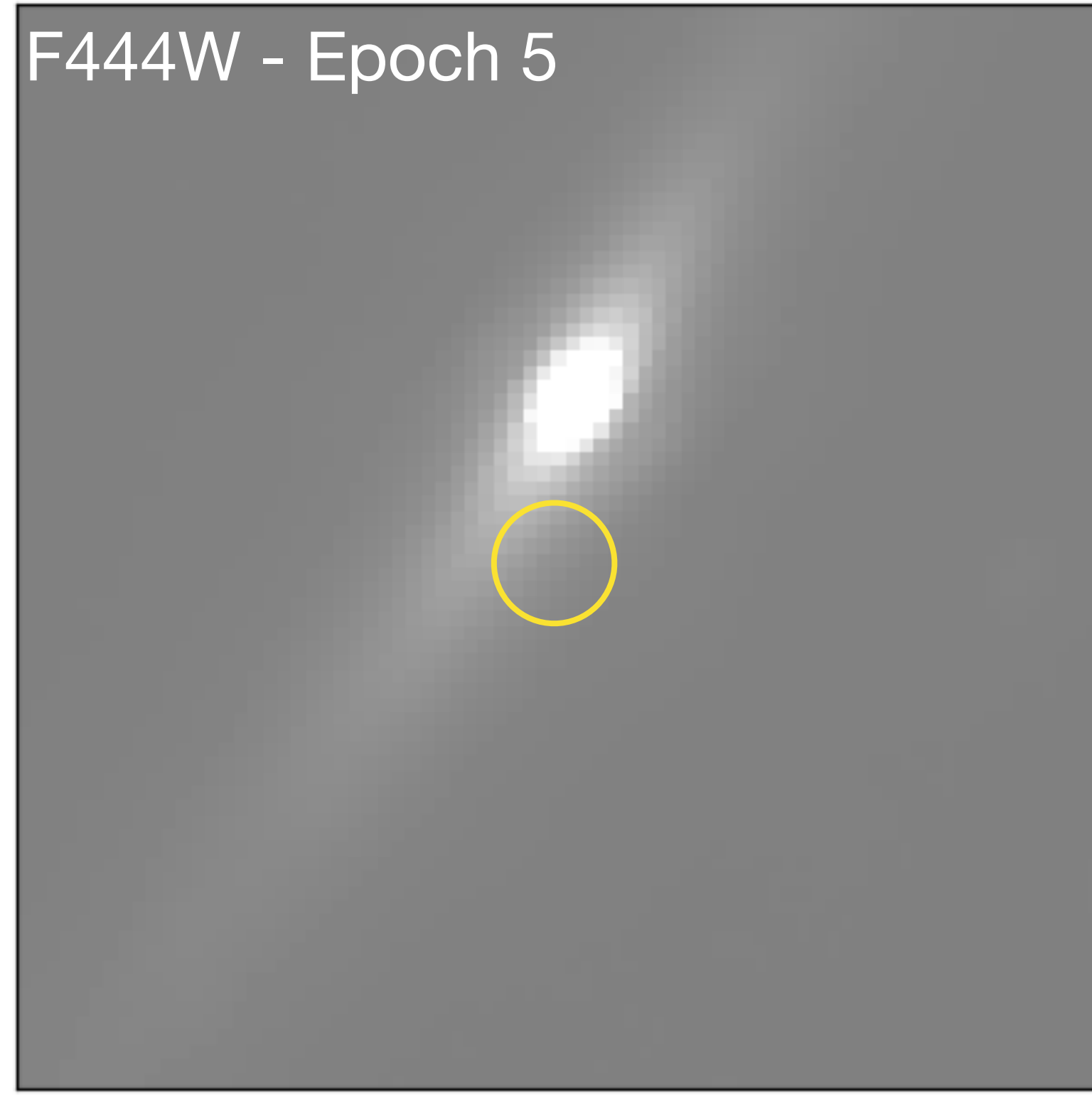


RESIDUAL

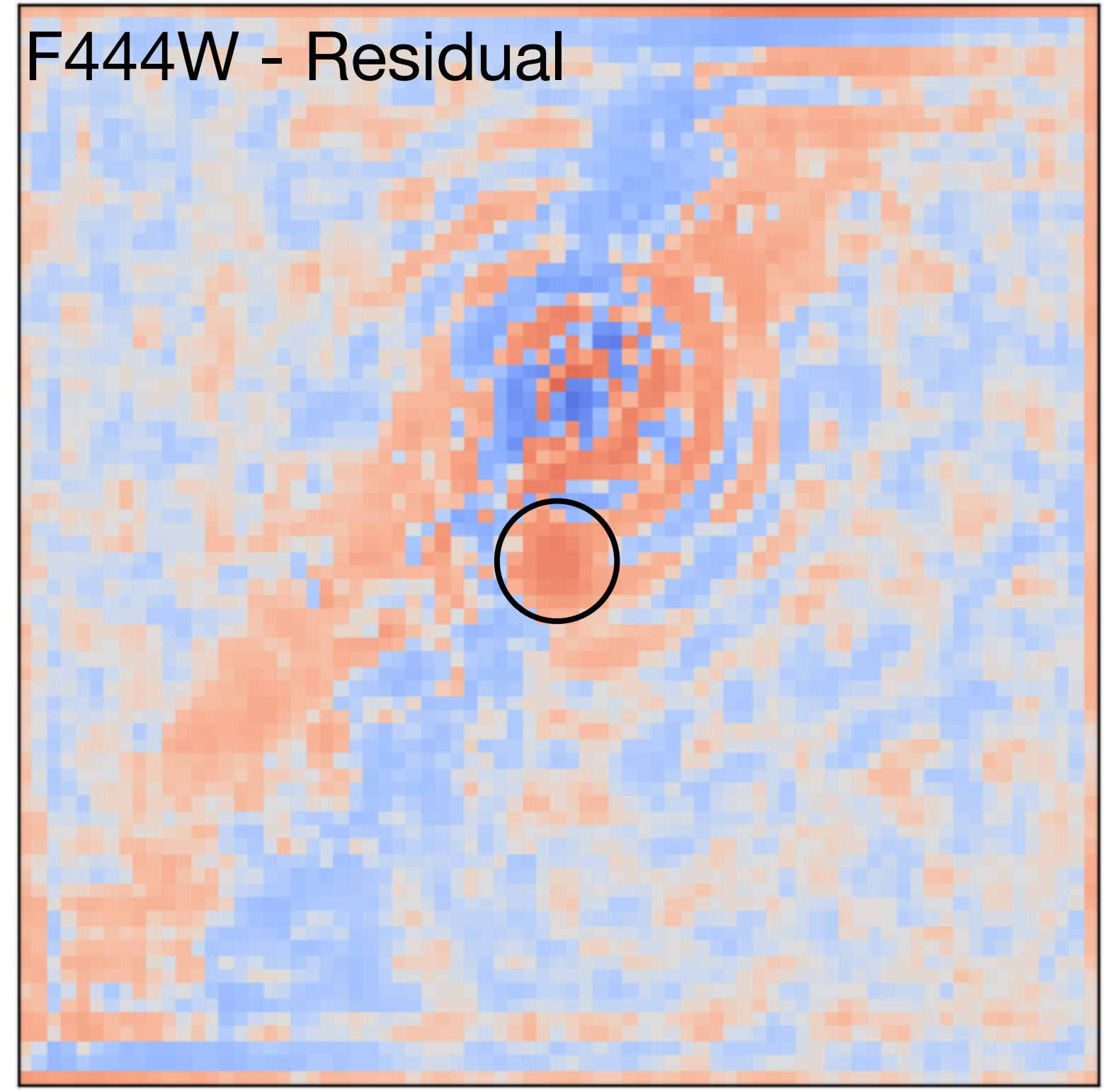
Preliminary Results



SCIENCE IMAGE

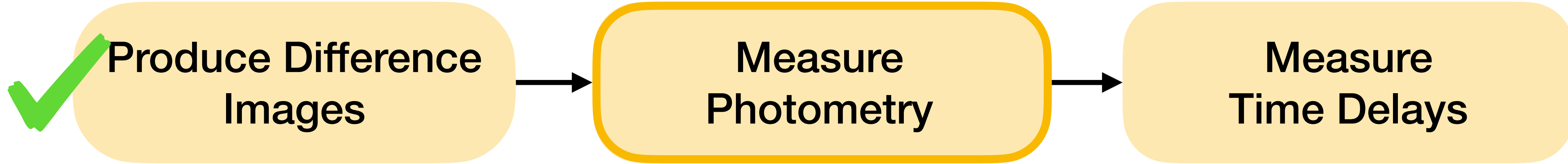


REFERENCE IMAGE

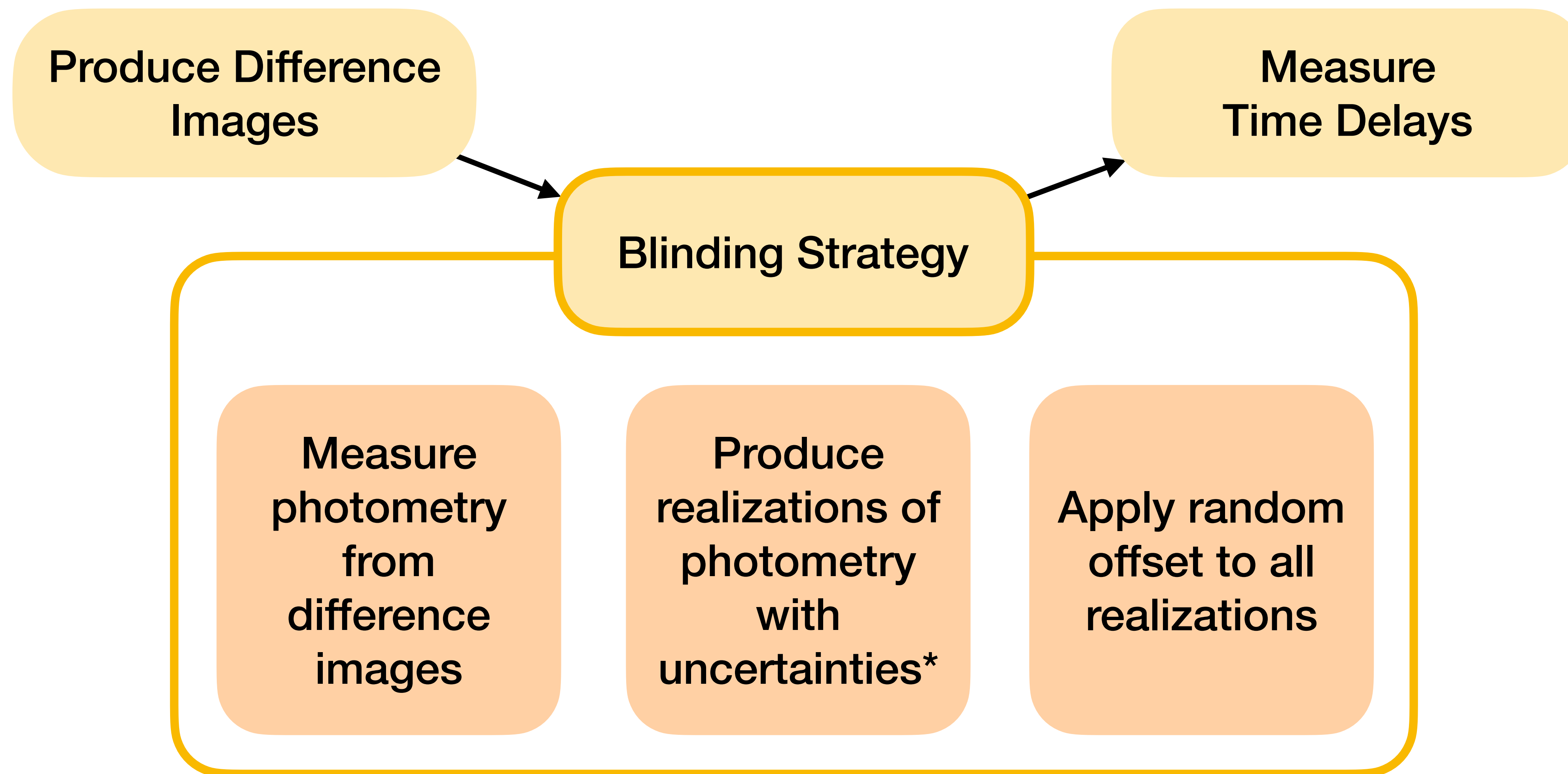


RESIDUAL

Next Steps and Blinding Strategy



Next Steps and Blinding Strategy



**Details to be finalized*

Summary

1. Traditional difference imaging techniques don't work for G165
 - ➡ Found a new work flow to tackle PSF matching issues
 - ➡ Photometric measurements in 2 additional LW filters using the template!
2. A blinding strategy is needed to prevent biased time delay measurements.
 - ➡ Blinding chief will measure and produce realizations of photometry.
 - ➡ The true data will be revealed after all analysis is done during unblinding.