

# **The Current State of AO Galaxy Observations**

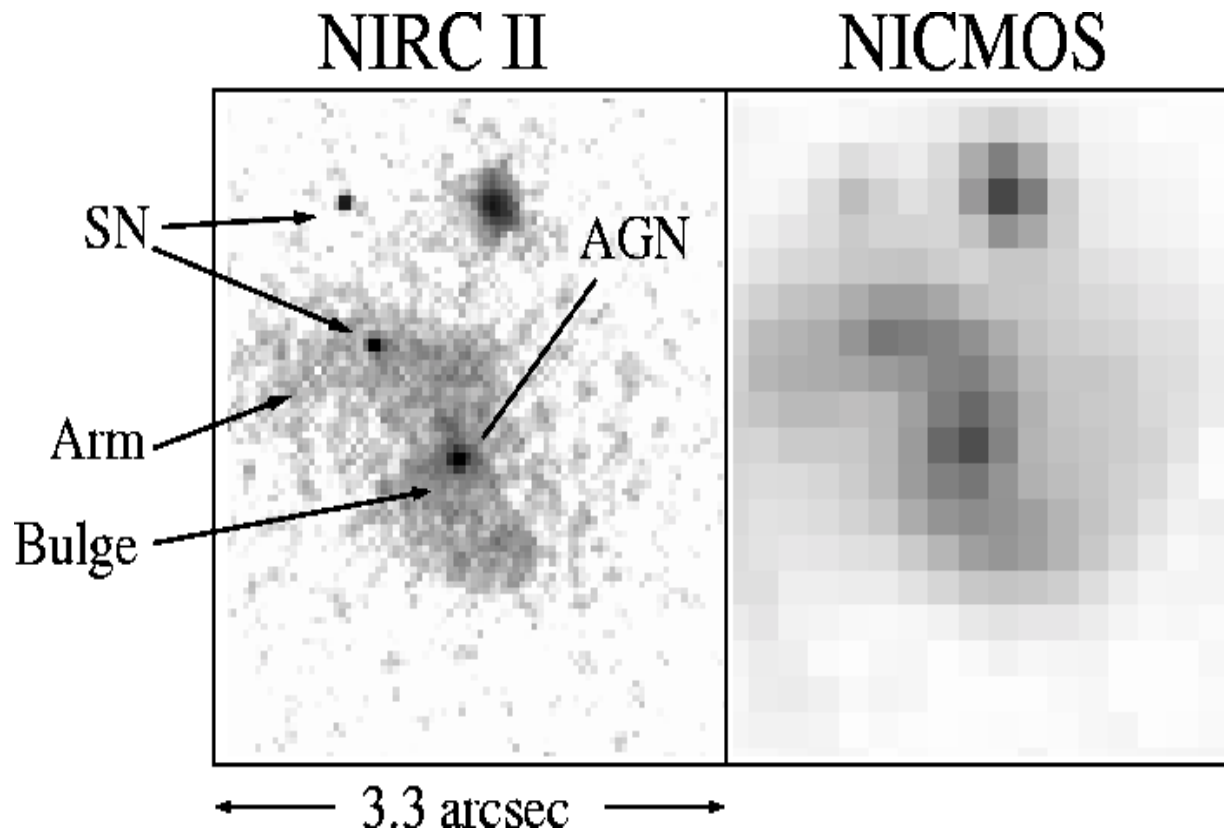
**Matthew Barczys, UCLA**

**CfAO Fall Retreat 2002 - Nov. 7-10, 2002**

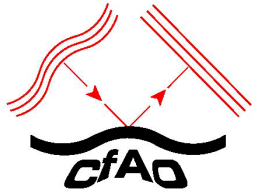


# Near-Infrared AO Imaging of Galaxies

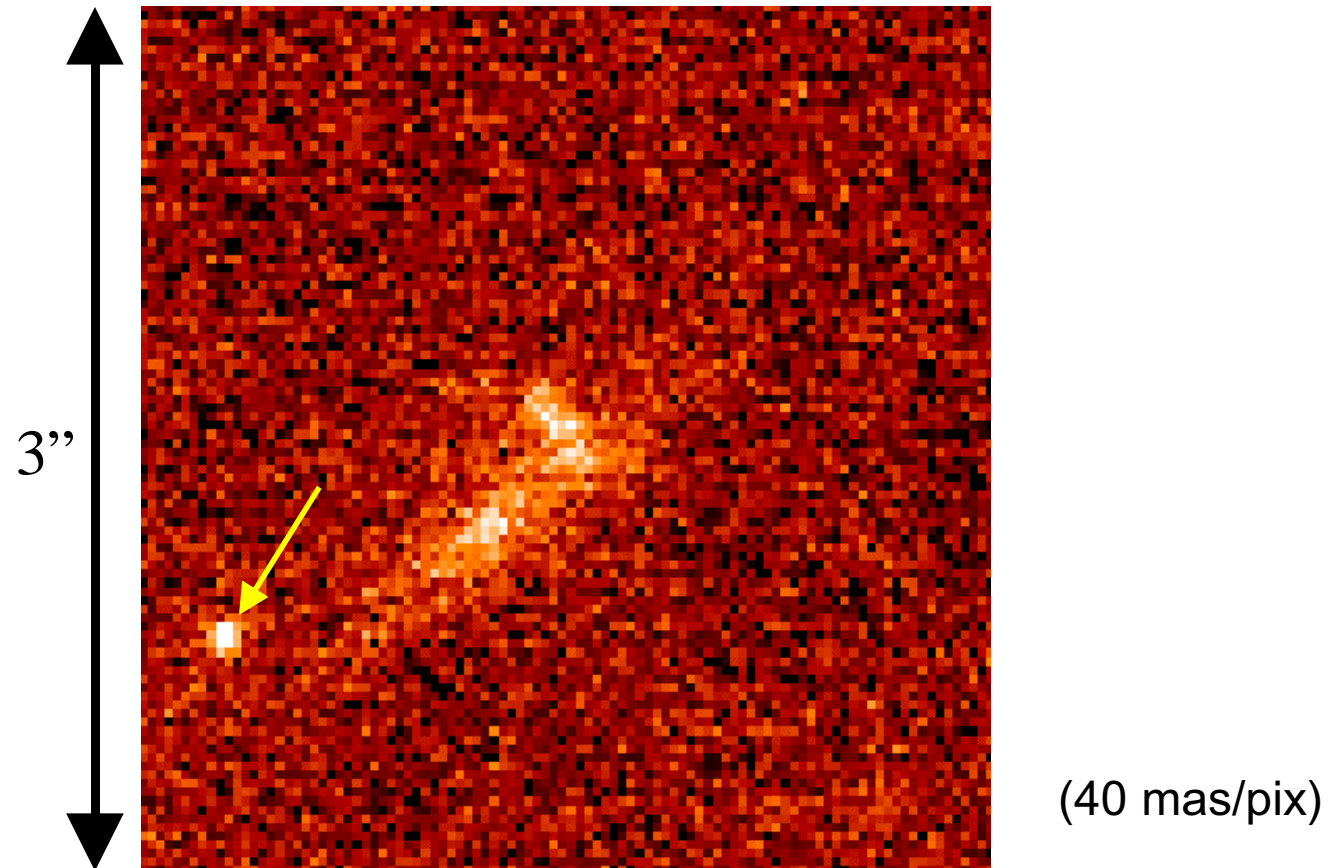
*What was thought to be possible...*



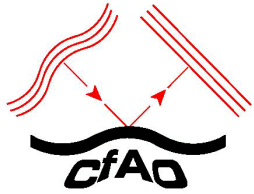
- Simulated galaxy ( $H \sim 20$ ) image from NIRC2 (15 mas/pix) and HST/NICMOS (200 mas/pix). The SN and AGN are each  $H \sim 25$ . (R. Bouwens)



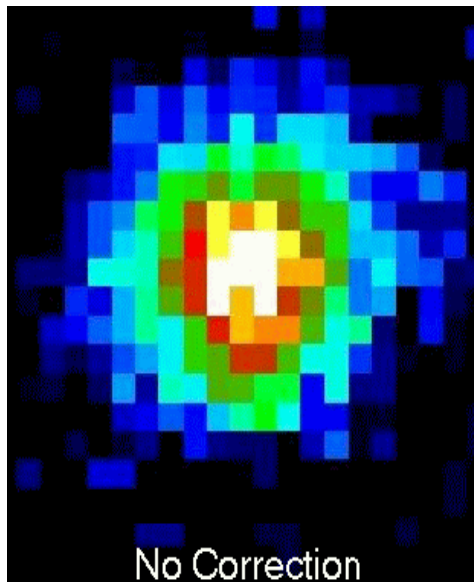
## Near-Infrared AO Imaging of Galaxies *IS Possible!*



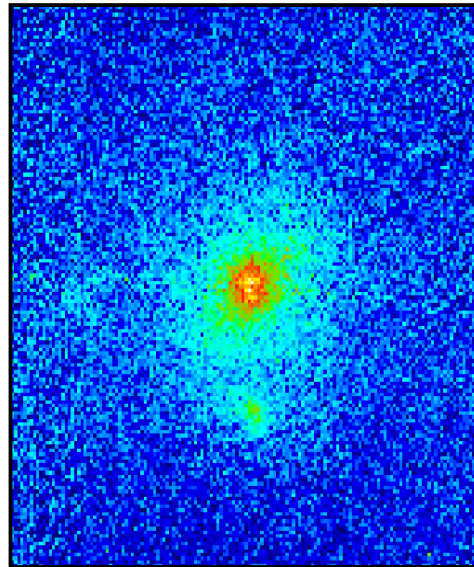
- Real galaxy imaged with Keck AO and NIRC2. Galaxy is  $H\sim 20.5$ , and point source is  $H\sim 23$ .



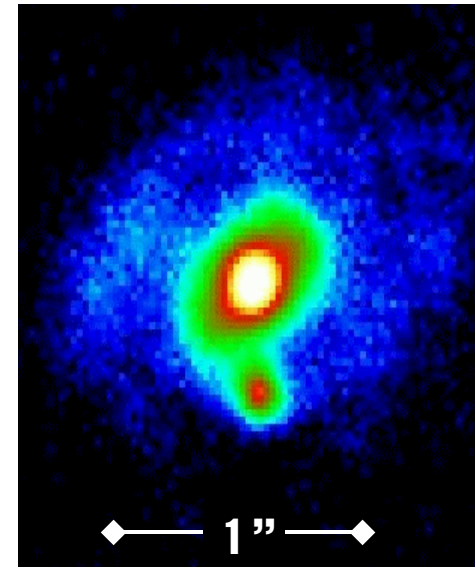
## Near-Infrared Galaxy Imaging Capabilities



No Correction  
Non-AO NIRC  
(150 mas/pix)

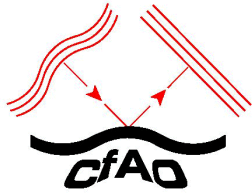


NIRSPEC/SCAM  
(18 mas/pix)



NIRC2  
(40 mas/pix)

- Galaxy (PPM114182+6+27) imaged by three generations of Keck cameras.
- *These capabilities have enabled surveys of faint field galaxies...*



# Keck AO Imaging Survey of Faint Field Galaxies

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- **Motivation:**

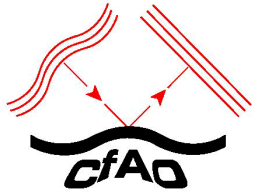
- Image distant field galaxies around bright NGS at high angular resolution to measure the morphologies of disks and bulges, and to study evolution of these galaxy sub-components.

- **Initial Survey:**

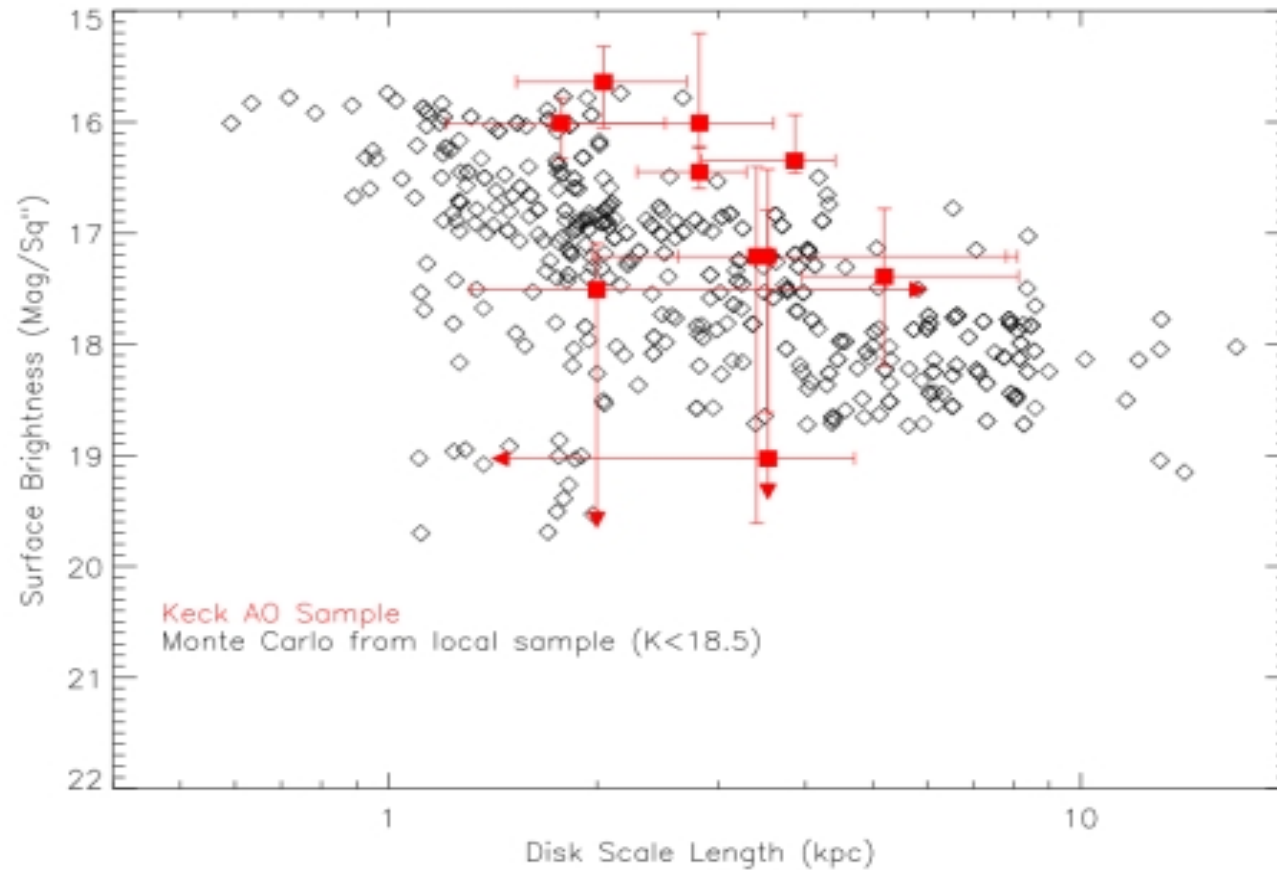
- Began in 1999
- 12 galaxies with  $H < 18.5$  imaged with KCAM and SCAM ( $\sim 4''$  fields of view)
- Average redshift is  $z \sim 0.55$
- Thesis - Tiffany Glassman (UCLA)

- **NIRC2 Survey:**

- Began in 2001.
- $> 200$  galaxies to  $H \sim 23$  in 17 NIRC2 fields ( $40''$  field of view)
- See poster and talk “Galaxy Evolution at the Keck Diffraction Limit”



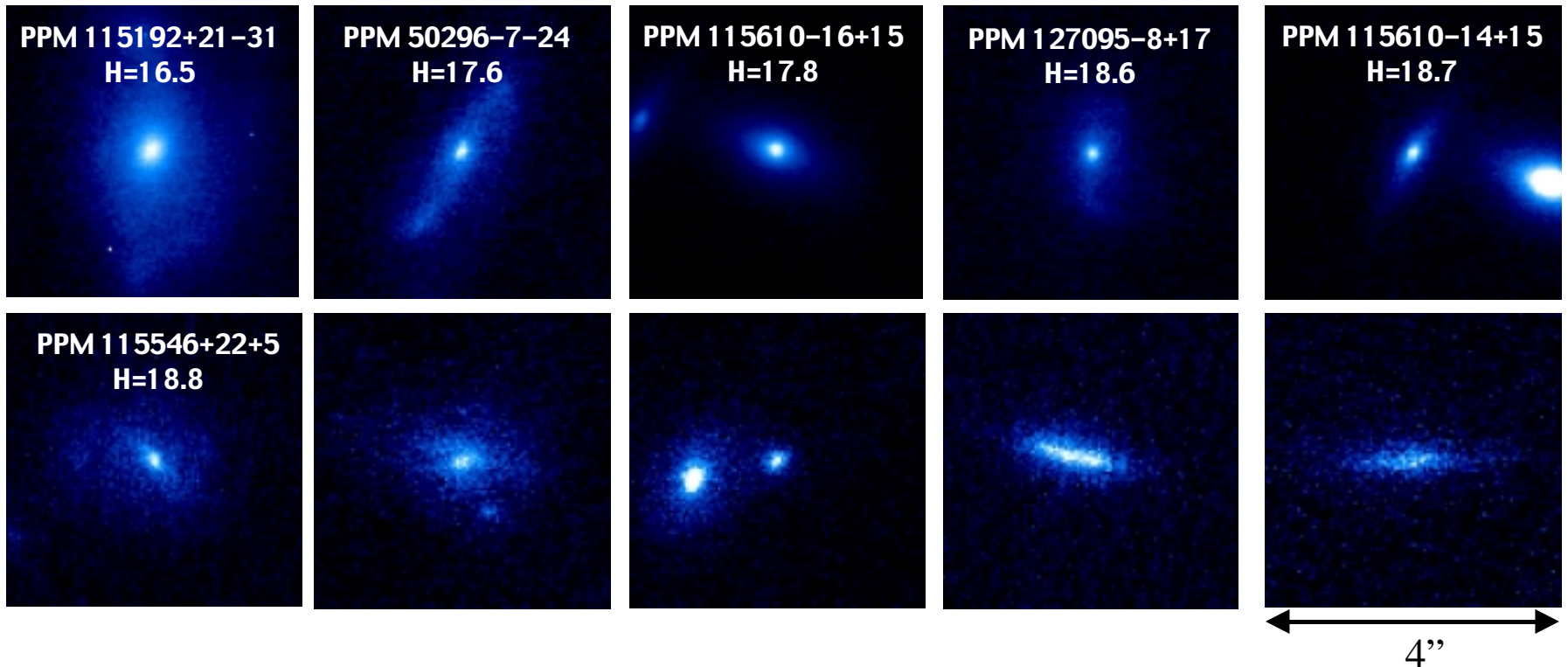
## Initial Imaging Survey Demonstrates Scientific Possibilities



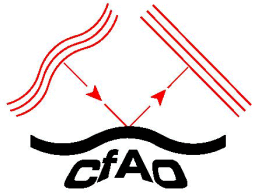
- Initial Keck AO survey shows that disks at  $z \sim 0.55$  are  $\sim 0.6 \text{ mag}/\square''$  brighter than local disks in DeJong's sample.



## Individual Galaxies from NIRC2 Sample and Early Indications



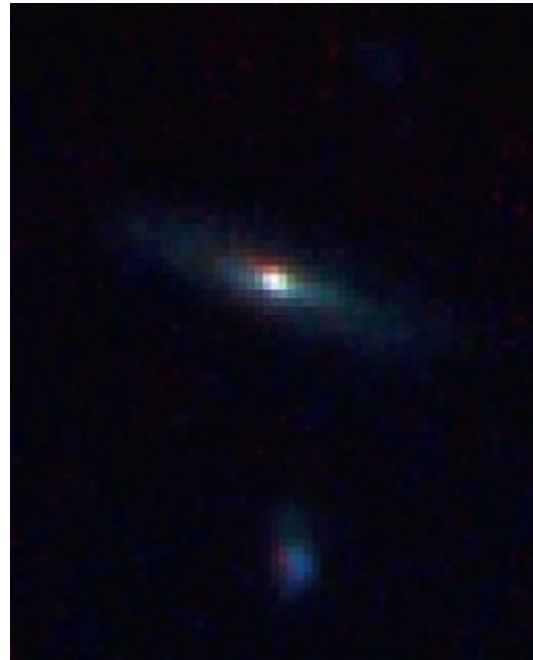
- 10 galaxies with  $H < 20$  out of more than 200 galaxies with  $H < 23$  in 17 fields ( $\sim 8$  sq. arcmin)
- Lots of Bars and Close Companions, Some Point Sources (possibly embedded)
- *Existing surveys show possibilities with single-band imaging data...*



## Benefits of Multi-wavelength Data

GSS 294 3364  
 $z=0.651$

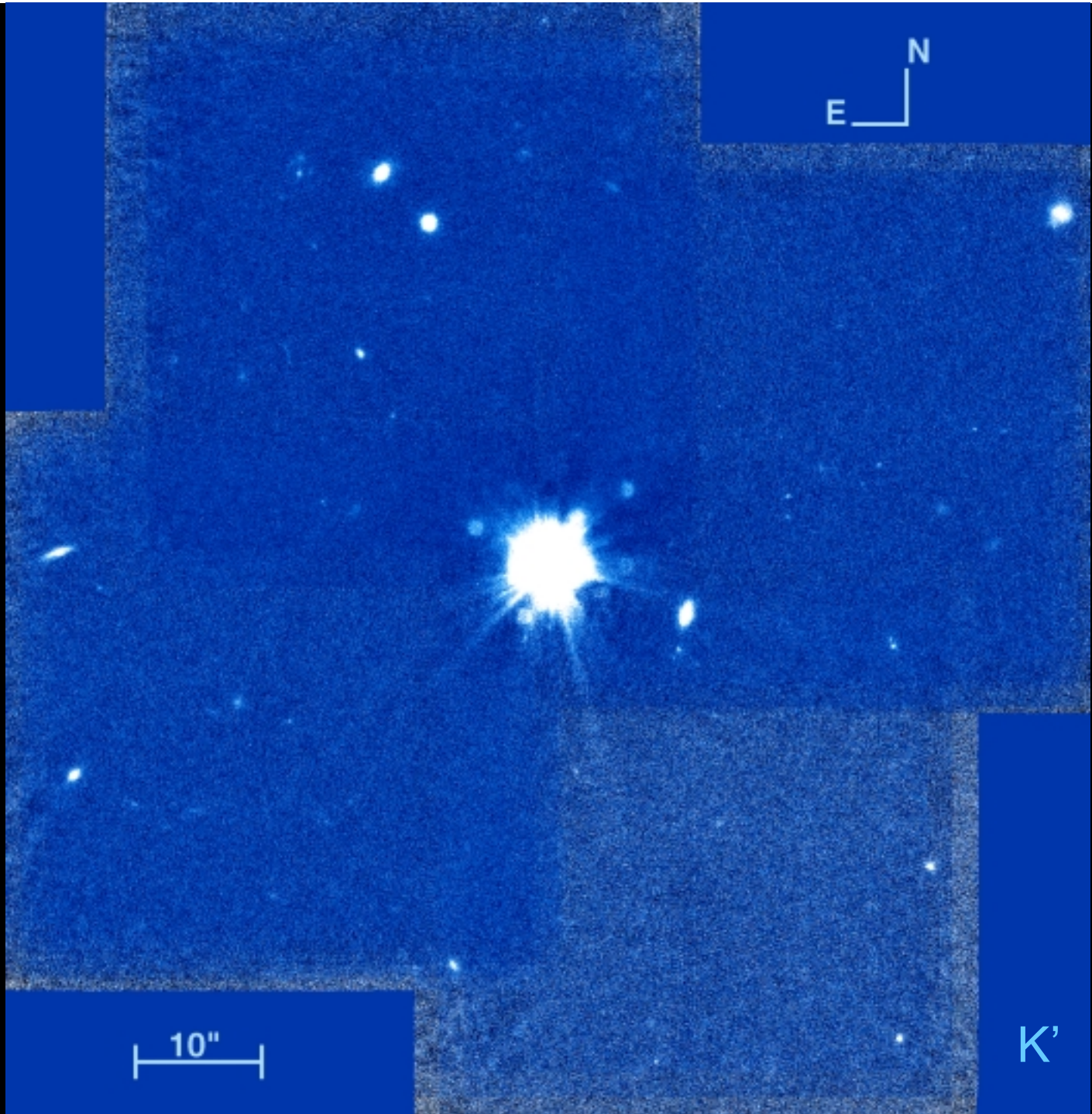
GSS 294 3367  
 $z=0.928$



JHU 2375  $z=0.531$

- **Optical/NIR Three Color Images enable colors and color gradients to be measured**
  - Blue = HST V-band, Yellow = HST I-band, Red = Keck AO K'-band
- **At UCSC: Galaxy decomposition and stellar population synthesis modelling.**

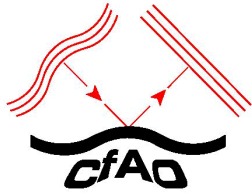
# GOODS- North



(see poster  
for more)

10"

K'



## Pilot NGS Observations of GOODS-North

- **Observations: Keck AO and NIRC2, May 30-31, June 1, 2002 with Matthews and Soifer (Caltech)**
- **Natural Guide Star: USNO-A2.0 1500-05579958**  
 $RA_{2000}=12^h 37^m 38.11^s$ ,  $DEC=62^\circ 16' 32.0''$
- **Image Quality:  $0''.15 - 0''.20$  FWHM**
- **AO WFS Rate:  $\sim 70$  Hz**
- **Airmass:  $\sim 1.5$**
- **Integration Time:**
  - NE: 90 min
  - NW & SE: 54 min
  - SW: 18 min

