NIRISS AMI GTO

Anand Sivaramakrishnan
JAM + JAMex

FGS Science Team meeting
20 October 2015 Université de Montréal

NIRISS AMI JAM & JAMex GTO

Smaller GTO program than NIRISS Key Projects

Select for strong science, low risk, short exposures

Demonstrate wide science applications

Import NRM experience and image processing expertise

- Several outside ***contributors*** already
- Clarify their participation now to avoid misunderstandings

Address open issues

- Contributor ideas not accepted for GTO stay contributor-owned?
- Integrate JAM work with U de M work
- Identify leads, task leads, products, schedule
- ***Work with other GTO teams – widen science, reduce overheads***

Contributor : not a core team member

Under development

AGN and ULIRG science (early written plan, ETC, targets)

GAIA followup – relative astrometry

Monitoring volcanoes on Io

- ‘astro’metry & photometry on volcanoes

Microquasars

YSO’s, transition disks

- Several outside contributors already
- Clarify to avoid misunderstandings w/collaborators

Various (Mira’s…)

Proposal organization suggestion

Proposal lead (assign tasks, info, assemble, find SNR req)
*eg **Sivaramakrishnan, Lafrenière,** Artigau **…***

Target specialists (science leads, sky scene generators)
*eg **Hutchings, Ferrarese**, Ford, Tuthill, Martel, **Lafrenière,** Artigau, Stansberry, Evans,..*

Data simulations lead
Thatte

OPS lead(s)
eg Martel for AGN/ULIRG

Data reduction leads (various, depending on expertise)
*eg Greenbaum, Thatte, **Sivaramakrishnan** – determine exposure, and analysis tweaks – "beyond pipeline reduction" for Cycle 1*

Paper lead writer and main authors
***EC approval** for author list*

Ideas written up

ApJ 2014: ACTIVE GALACTIC NUCLEUS AND QUASAR SCIENCE WITH APERTURE MASKING INTERFEROMETRY ON THE *JAMES WEBB SPACE TELESCOPE*

K. E. Saavik Ford1,5,6, Barry McKernan1,5,6, Anand Sivaramakrishnan2,3,5, André R. Martel2, Anton Koekemoer2, David Lafrenière4, and Sébastien Parmentier3

STScI Newsletter:

GPI/SPHERE follow-up (DL)

GAIA follow-up: Artigau

AGN feedback: AS+others

https://blogs.stsci.edu/newsletter/files/2014/07/new-NIRISS.pdf

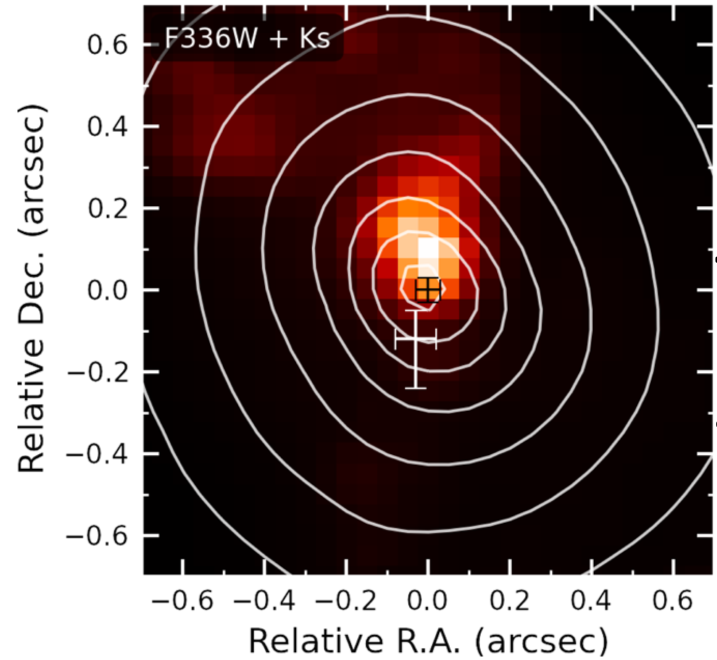
Aperture-Masking Interferometry with *Webb*'s NIRISS

Anand Sivaramakrishnan, *anand@stsci.edu*, **& Étienne Artigau,** *artigau@astro.umontreal.ca*

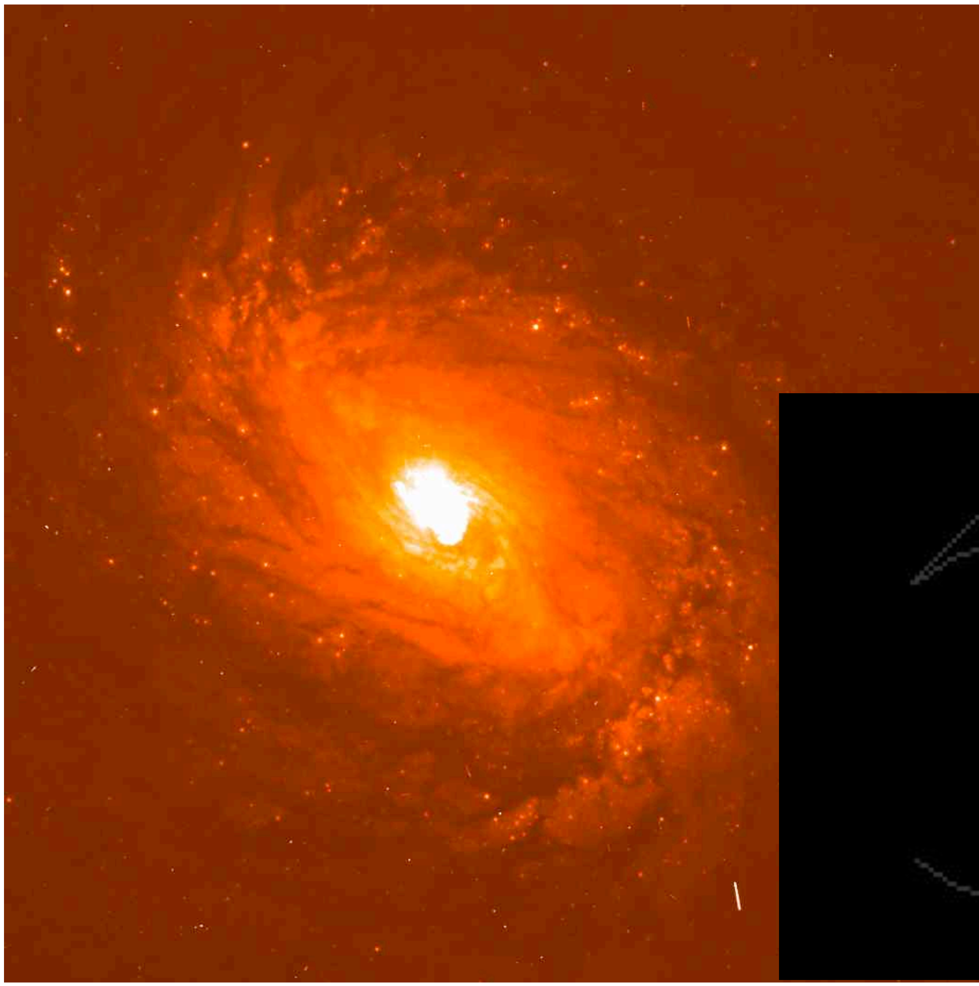
PASP – submitted: Observing Outer Planet Satellites (except Titan) with JWST: Science Justification and Observational Requirements

Laszlo Keszthelyi1, Will Grundy2***, John Stansberry3, Anand Sivaramahkrishan3, Deepashri Thatte3,*** Murthy Gudipati4, Constantine Tsang5***, Alexandra Greenbaum6, Chima McGruder7***

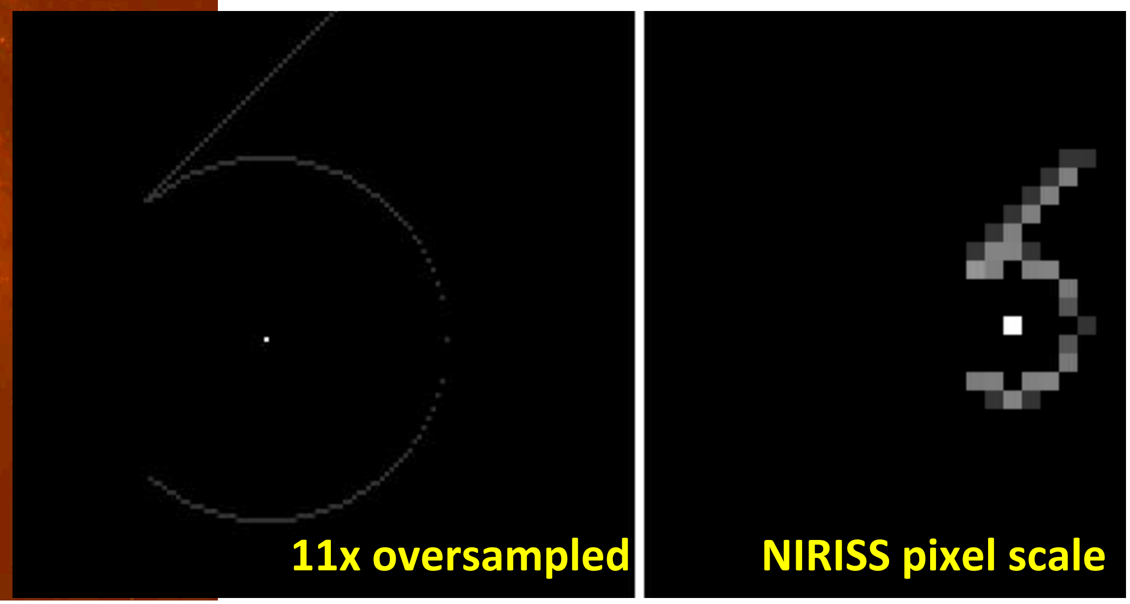
N1068



Prieto et al. 2014

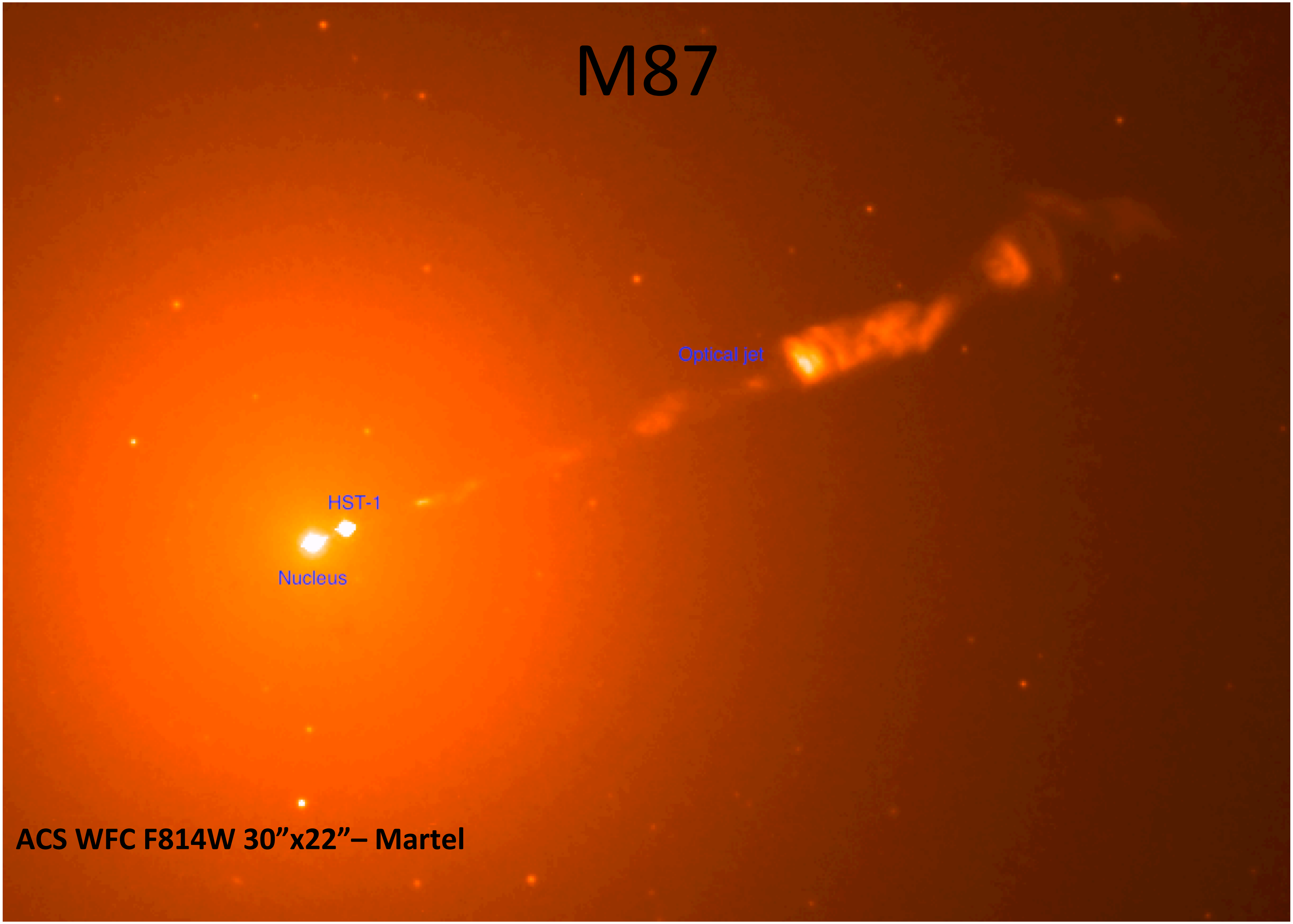


ACS WFC F814W drizzled 55”x55”– Martel



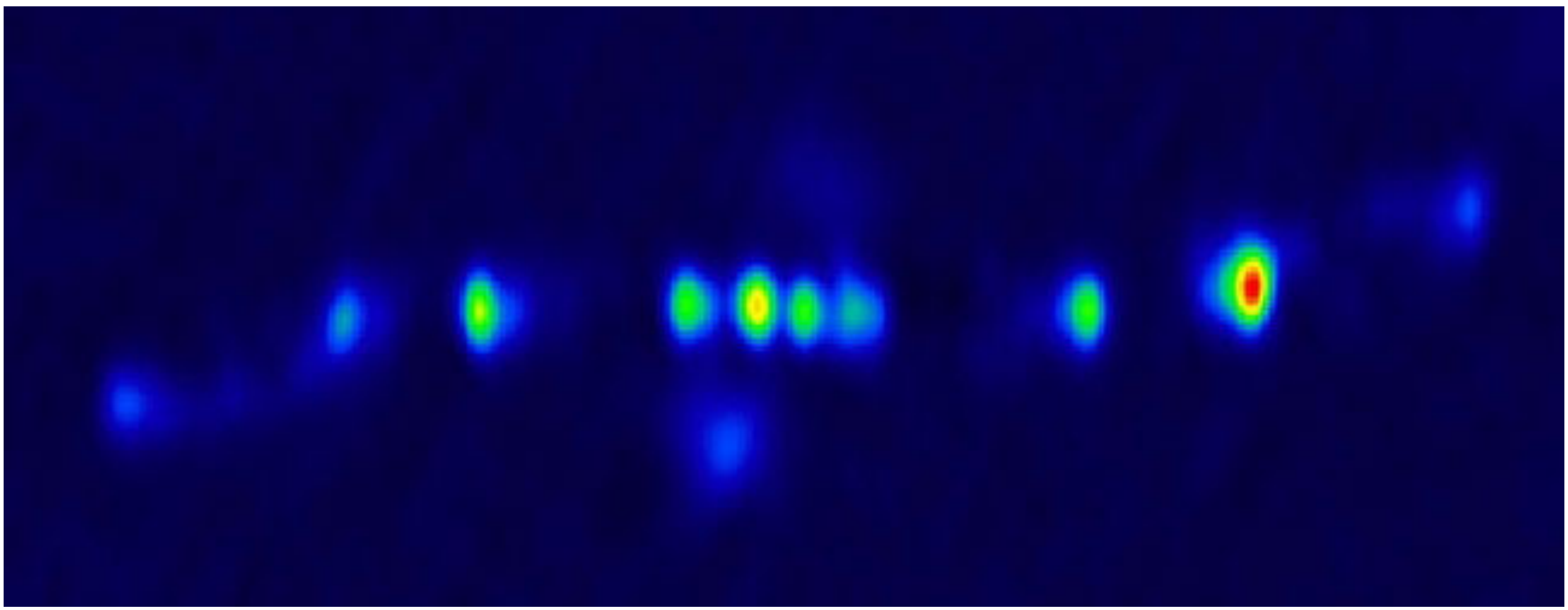
Mimic Gradatour 2006 3.5um data

(McKernan & Ford) – simple input ‘sky’


M87
Optical jet
HST-1
Nucleus
ACS WFC F814W 30"x22"– Martel

Microquasars

SS 433 (radio) 400 mas edge to edge, or ~6-8 resolution elements



Microquasars

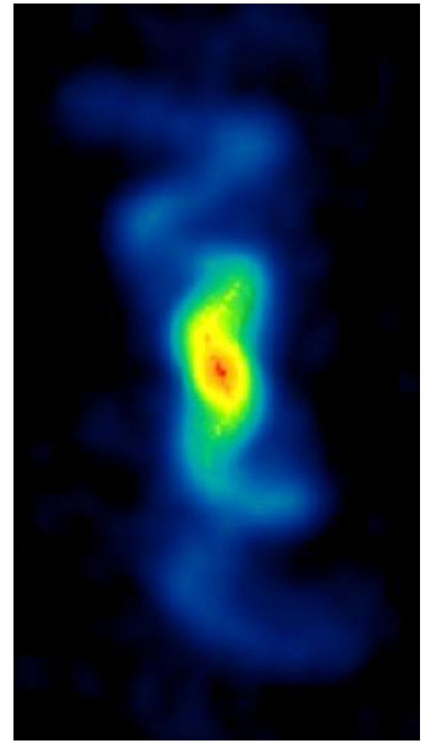
Local analogs of cosmological AGN

Relativistic jet physics will be encoded in faint jet structures in immediate circumbinary environment

Potential JWST/NRM targets:

Name	Kmag	Notes
SS 433	8.0	Black-Hole/A star 13-day binary
V694 Mon	5.1	W.Dwf(?) + Symbiotic Mira
CI Cam	4.3	Neutron star + B star?
Cir X-1	10.7	Neutron Star + ?
Sco X-1	11.1	Neutron star + K star

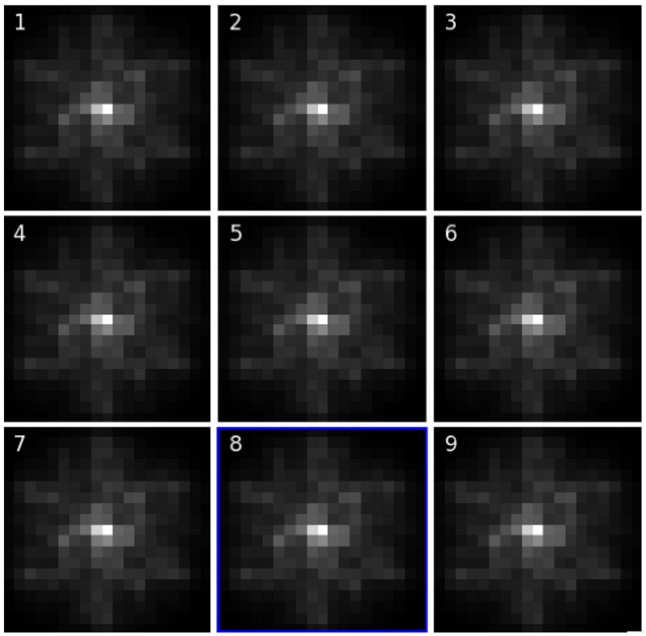
Note: Many bright systems with similar physics / jets / accretion classified as Symbiotic (e.g. Hen 2-90) may be valid targets also



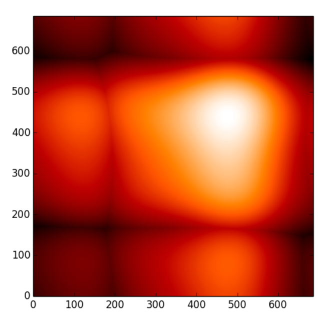
SS 433 radio image: Blundell & Bowler 2004 ApJ 616 L159

JWST Cryovac CV2RR: Astrometry

Thatte et al. SPIE 2015

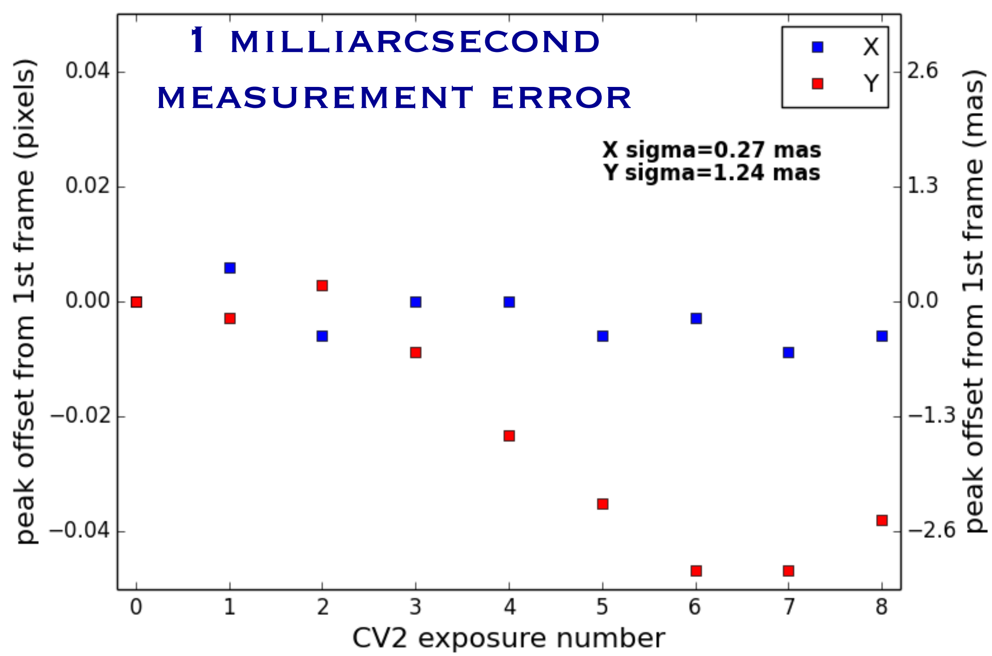


cross-correlation of data with oversampled PSF



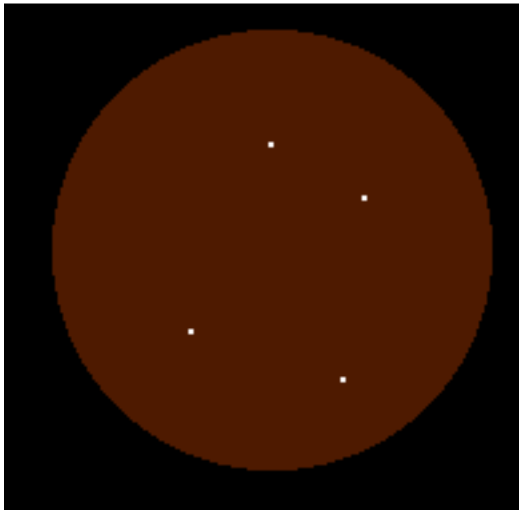
OSIM test on subpixel dithering: source failed to move on first several commands. Use this to determine internal astrometric accuracy by fitting Lacour-Greenbaum analytical PSF model to data, extract centering.

X and Y offset of the peak of PSF from the first frame

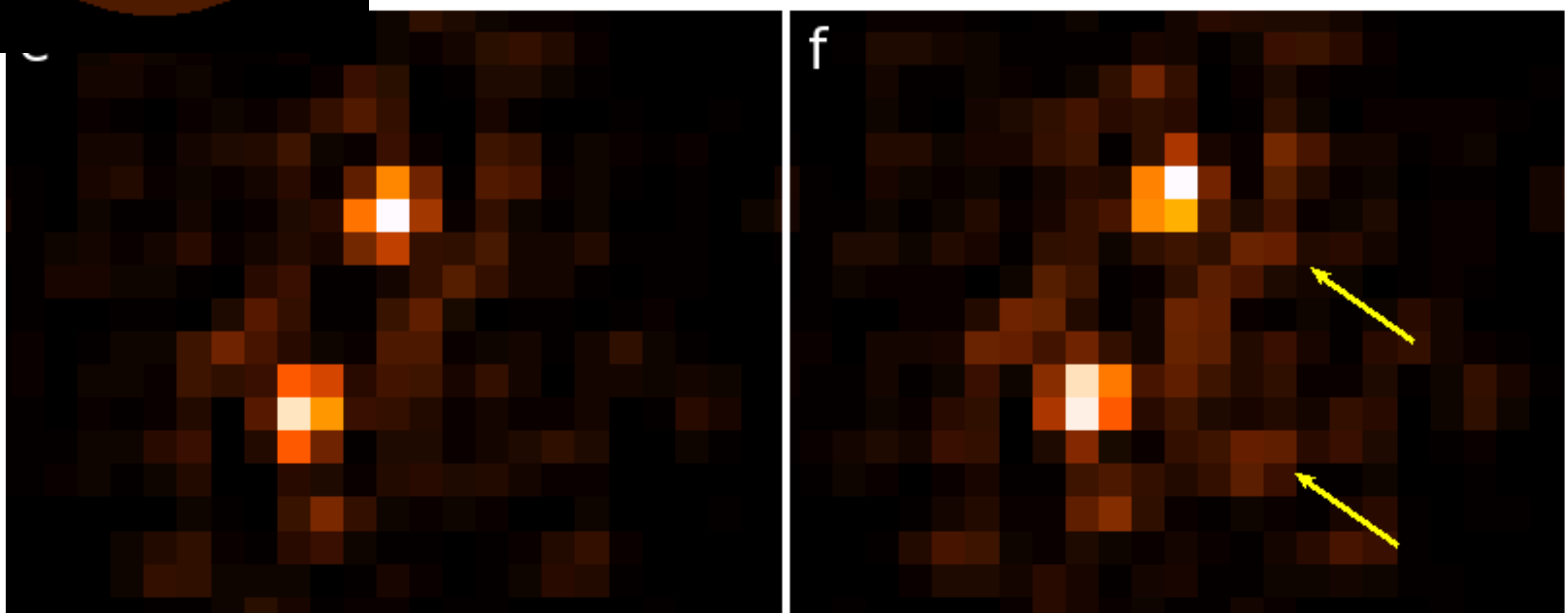


Io volcanoes

SS science, Io interior physics



STScI Newsletter 2015 (submitted):
Thatte, Sivaramakrishnan, Stansberry
'astro'metry & photometry of volcanoes:
first points in monitoring program



Debris Disks and Exo-Zodis

New Findings: H-band high precision interferometry finds ~10% of bright stars show 0.5 – 1% visibility decrement at origin – presumed due to hot dust

- Current Observations: Limited by ~percent V^2 measurement precision. ExAO unlikely to do significantly better.
- JWST/NRM should deliver orders of magnitude more precision.
- Likely that much larger fraction of stars will offer detections.
- ***JWST will explore cooler dust further out corresponding to the habitable zone (H-band dust is hot and close)***.

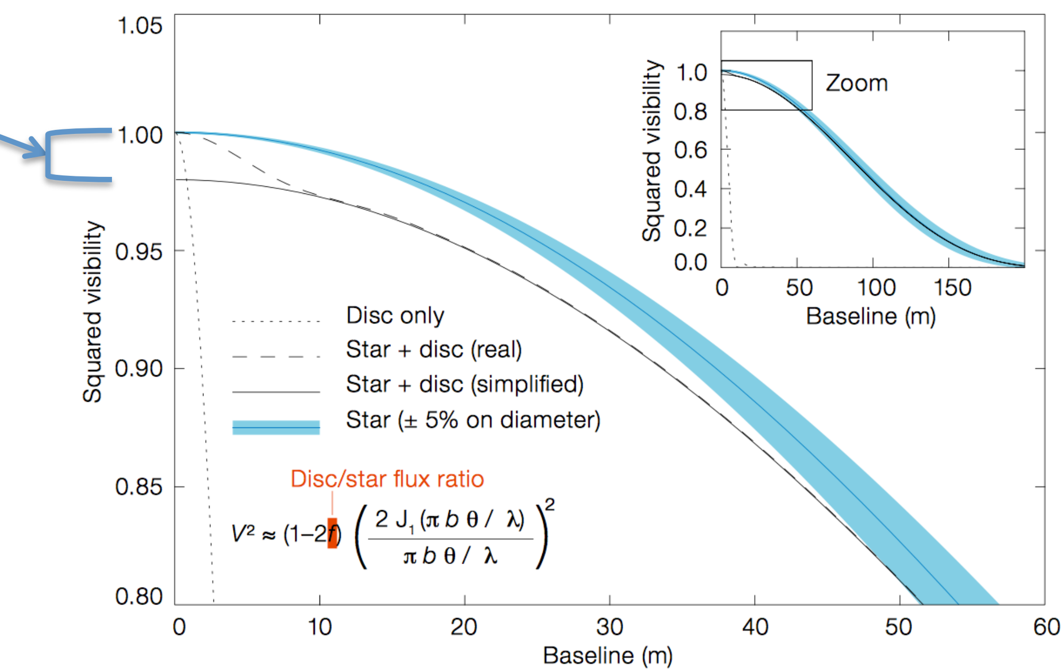
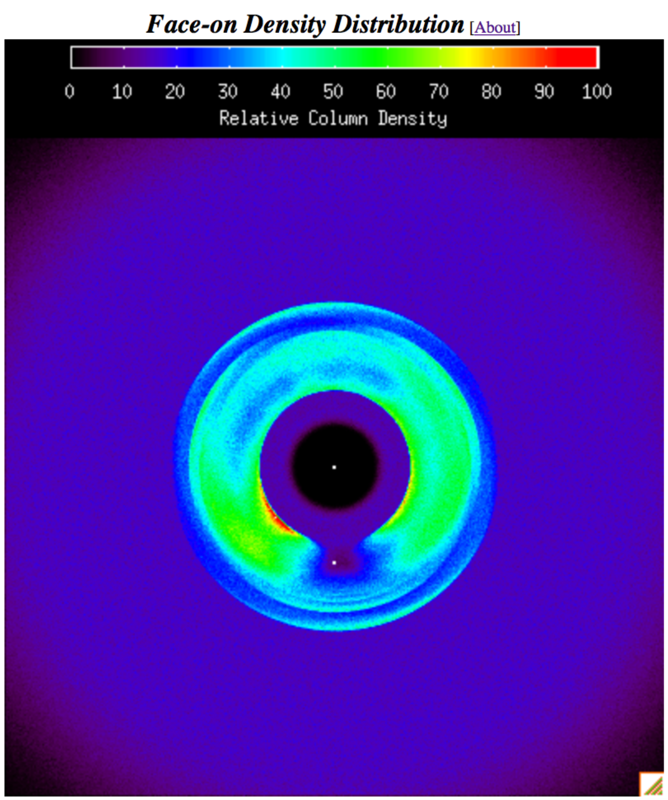


Figure from Ertel et al ESO Messenger March 2015

Planetary Signatures in Zodi Dust

Gravitating bodies can imprint various signatures in circumstellar dust. Examples below from simulation of a 5 earth-mass planet at 6 AU from host star Density (left) and mid-IR image (right).

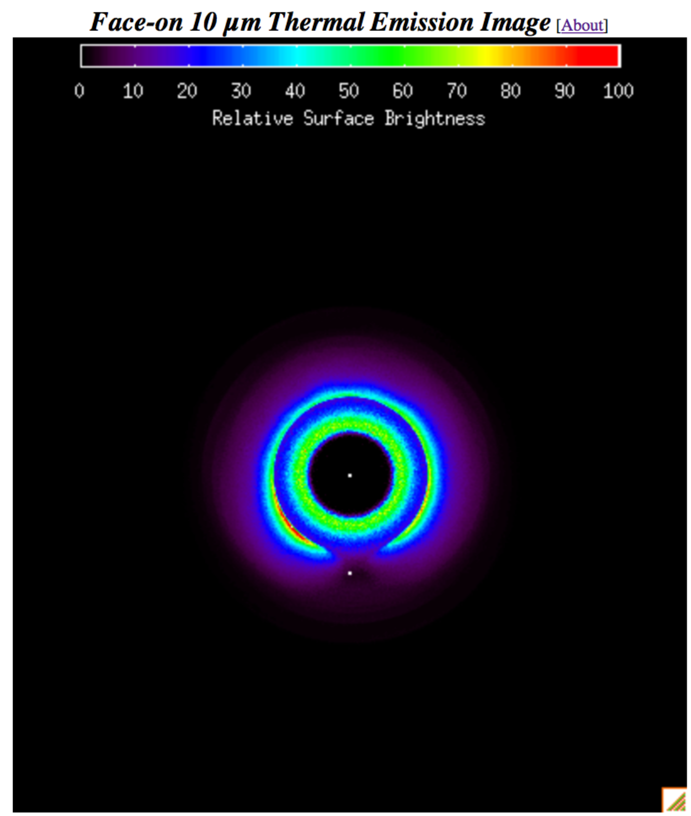


Planet parameters
$M_p = 5.0\ M_{Earth}$
$a_p = 6.0$ AU

Dust parameters
$\beta = 0.073$
$0 < i_{parent\ bodies} < 20^o$
$21 < a_{parent\ bodies} < 26.25$ AU

[Download IDL .sav file]

Pixel size = 0.105 AU



Simulations from Christopher Stark's Exozodi Simulation Catalog available at:
http://asd.gsfc.nasa.gov/Christopher.Stark/catalog.php

Exoplanetary Characterization

- Key missions will deliver JWST NRM targets: Tess; Gaia, Kepler/K2, various wide field transient surveys, ongoing RV surveys (e.g. Minerva).
- Example for Tess – should detect ~50 objects with radius greater than 10 Earth. 7 have primary Teff less than 5K, none less than 4K. This is from examination of Simulated Tess Catalog (Sullivan et al 2015 ApJ 809 77).