Software activities shaping the CHARA Array

Narsireddy Anugu + CHARA collaboration

2022 Mar 13

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CHARA beam combiners

	Wavelength	# of beams combined	Status
PAVO	R-band	2	In operation
CLASSIC/CLIMB	J+H+K	<= 3	In operation
MIRC-X/MYSTIC	J+H+K	6	In operation
SPICA	R-band	6	Commissioning phase
SILMARIL	H+K	3	Commissioning phase







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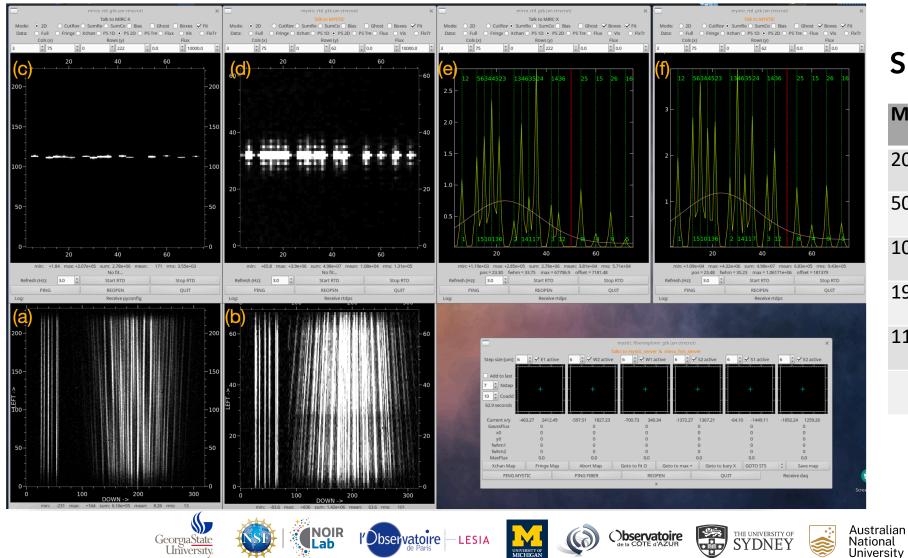






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1. MIRC-X + MYSTIC



Spectral resolutions:

MIRC-X (R)	MYSTIC (R)
20	20
50	49
102	100
198	278
1170	981
	1724

(See John's talk)

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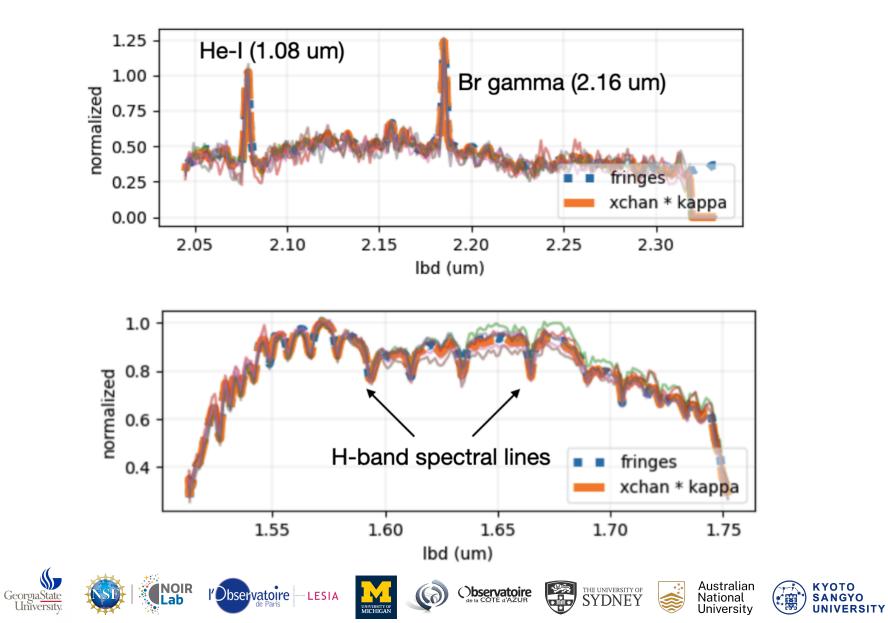
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1. MIRC-X + MYSTIC



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1. MIRC-X + MYSTIC: Two modes of fringe tracking

(1) Fringe tracker and science beam combiner Low R — fringe track

High R — science

For example, MIRC-X (low-R) and MYSTIC (high-R) MIRC-X (high-R) and MYSTIC (low-R)

(2) Combined mode: all the information is used for fringe tracking







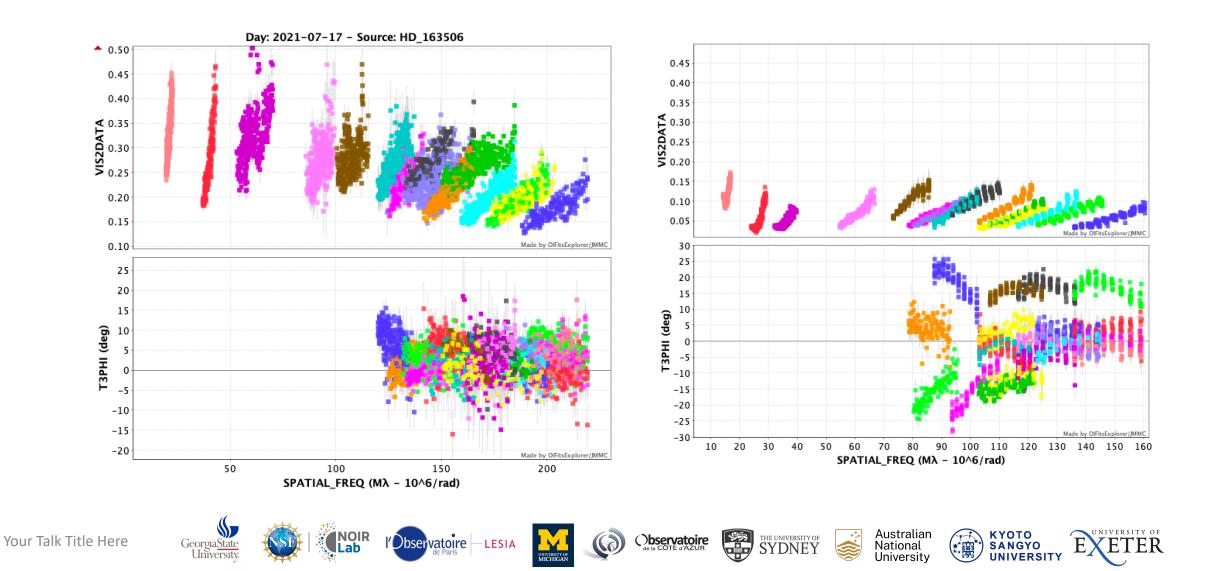








1. Combined mode for extended objects



2. SILMARIL

- 3-beam combiner
- CRED ONE camera
- Aimed for sensitivity to observe faint stars
- PI: Theo ten Brummelaar

(See Cyprien talk)

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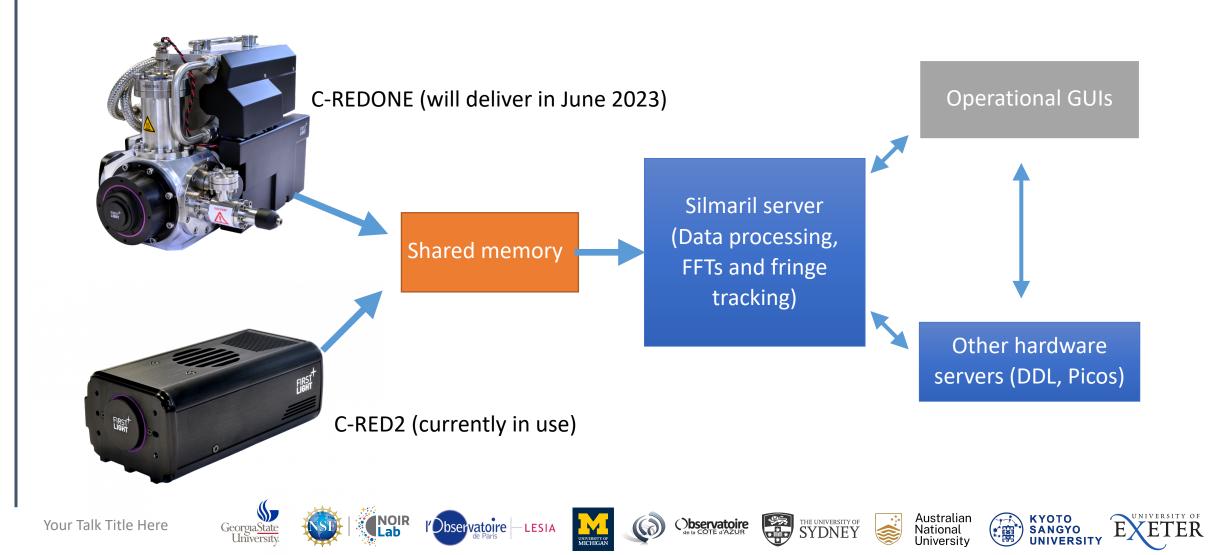
- We chose minimum development approach by using tested and working code
- We use MIRC-X software and GUIs, since the same camera and also users most familiar with mircx user interface



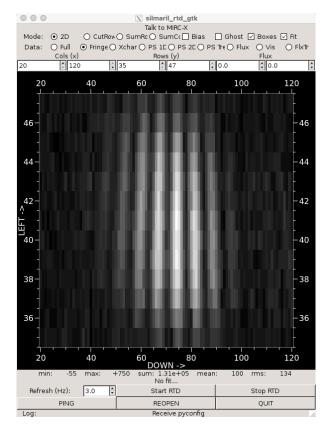




2. SILMARIL current status

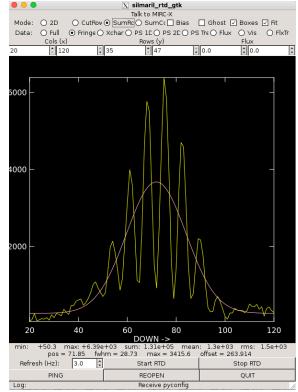


2. SILMARIL software working with lab STS (see Cyprien talk more details)

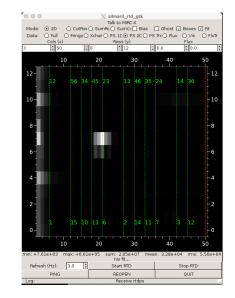


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E2 6	5 0	;	×	MAN	FT	×	<<	<	0	0.000	>	>>	0.00	÷	Loop-	Loop+		2 0.3	0.2	7.1	-	×	×
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3. Wavelength dispersion control

- With Denis, we developed a dedicated LDC (longitudinal dispersion correction) control
- This server can correct wavelength dispersion for SPICA and also J-band (MIRC-X) observations.
- Code adapted from ople to allow easy to play and for monitoring the computations.

(See Denis talk for how its being used)

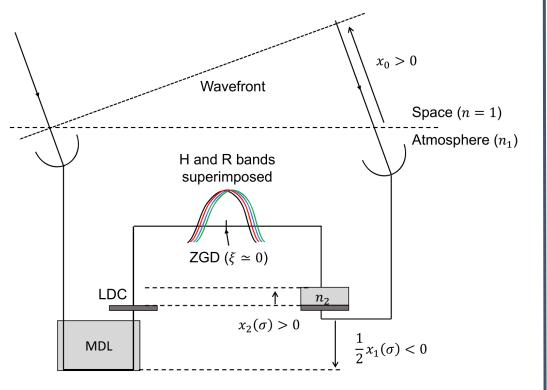


Image credit: Pannetier

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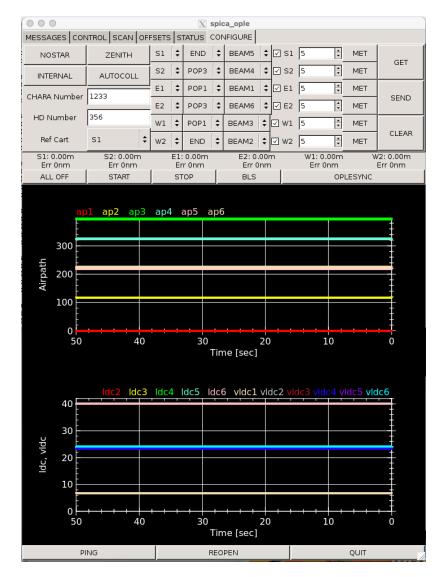
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3. Wavelength dispersion control















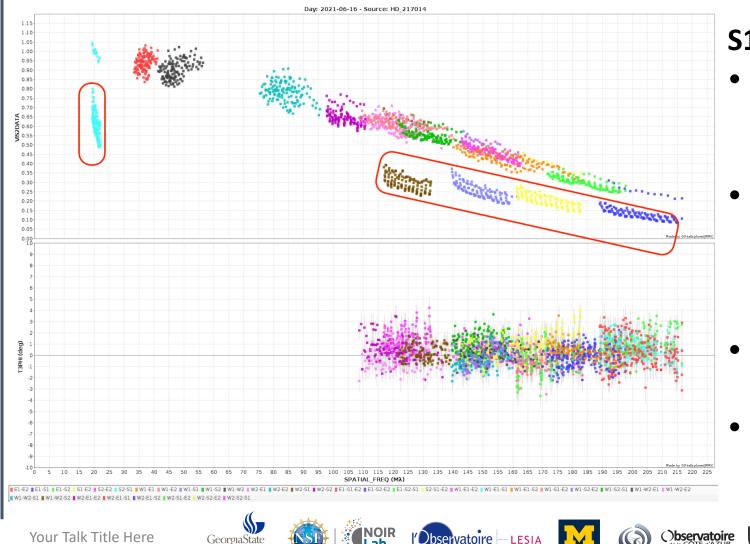




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4. Visibility loss issues



S1 visibility drops

- Between elevation = 45 60 and Azimuth ~100
- We checked telescope area, tip-tilt and AO systems and they seem NOT introduce any vibrations.
- We narrowed it down to the S1 cart.
- Current solution is keeping S1 as REF

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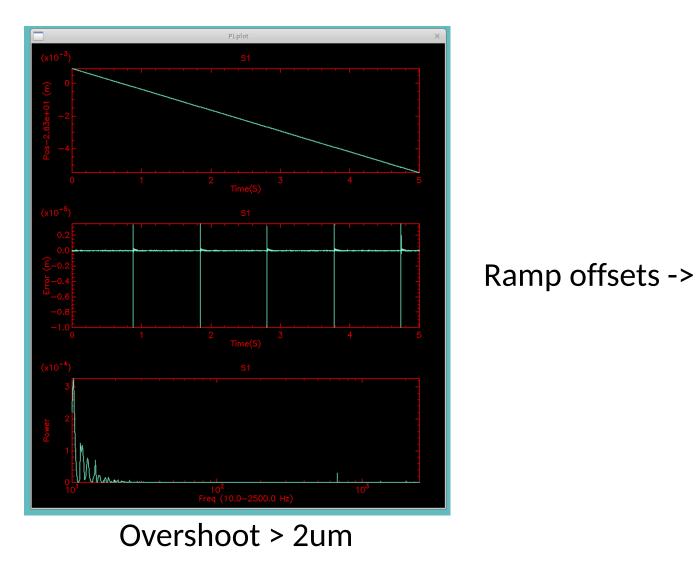
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5. Fringe tracking improvements













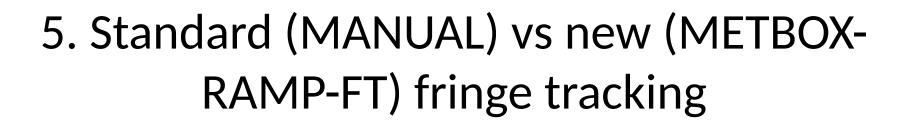




Overshoot < 0.1um

PLplot





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Data: ○ Full ○ Fringe ○ Xchan ○ PS 1D ○ PS 2D ● PS Tre ○ Flux ○ Vis ○ FlxTr Cols (x) Rows (y) Flux	Data: Full Fringe Xchan PS 1D PS 2D PS Tre Flux Vis FlxTr Cols (x) Rows (y) Flux	Data: O Full O Fringe O Xchan O PS 1D O PS 2D O PS Tre O Flux O Vis O FlxTr	Data: O Full O Fringe Xchan O PS 1D O PS 2D O PS Tre O Flux O Vis O FlxTr
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0 100 200	0 100 200		
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¹		S1-S2 45 S2-E2 46 S1-E2 56	S1-S2 45 S2-E2 46 S1-E2 56
S2-W1 34 S1-W1 35 E2-W1 36	30 - ^{52-W1} 34 51-W1 35 E2-W1 36 -30	52-W1 34 S1-W1 35 E2-W1 36 an	S2-W1 34 S1-W1 35 E2-W1 36
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MIRC-X

FT target M





MYSTIC



MANUAL target



MIRC-X





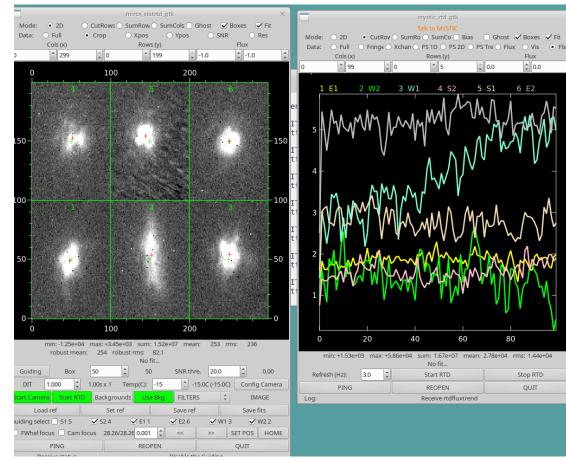








6. Flux stabilization with Star Tracker



Demonstration of beam stabilization (W1 loop was not closed)

- Along the beam train (>100m), all optics/actuators are in motion due to misalignments and temperature differences
- Which causes the beam drifts
- We track the beams using the Star Tracker and feedback to M7 actuator via labao sensor for stabilization

(See John's talk for more details)

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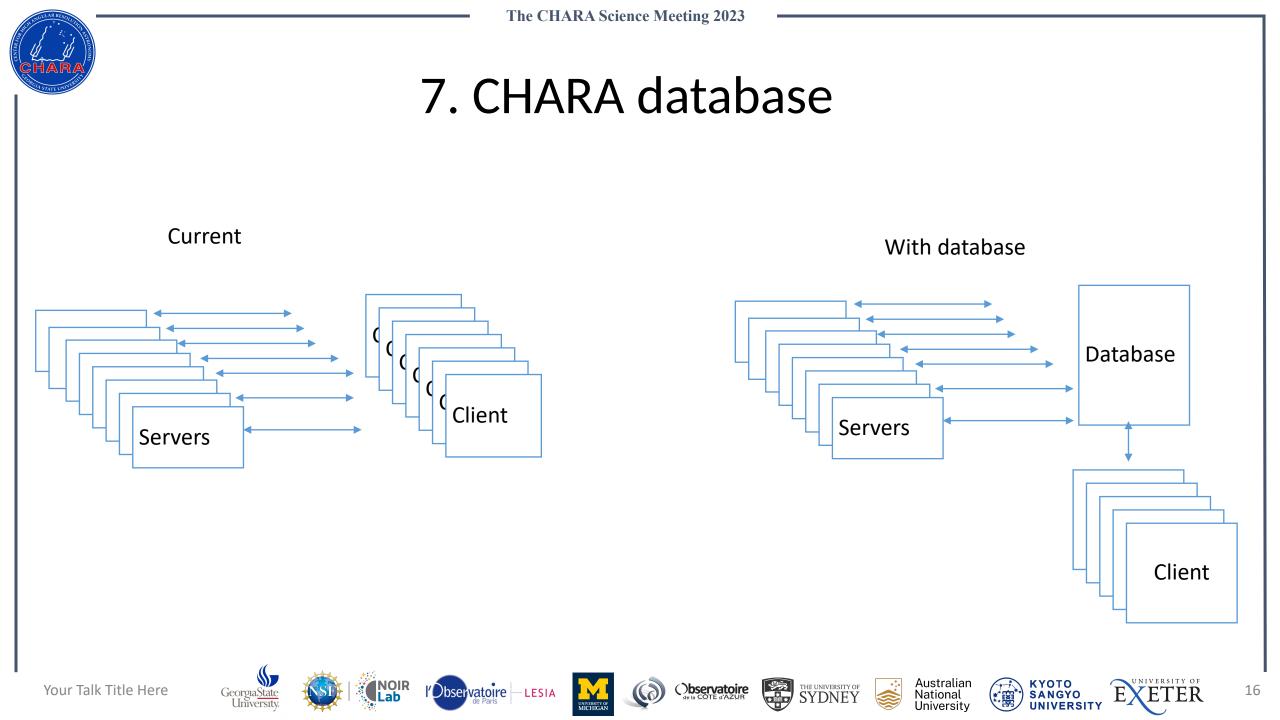
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Future works

















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8. CHARA client-server library upgrade

- The CHARA client-server library works great in good network conditions but have problems in slow network
- To solve we attempted zeromq, open-source messaging library

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- Zeromq is a high-speed, Muti-transport (TCP, UDP, IPC, and web socket ...)
- Zeromg being used for TMT common software
- The zeromg library is built into CHARA software and tested in the lab but need to be tested on-sky
- Rolling over between CHARA classic vs zeromq based client-server, unfortunately complex and abrupt because, we need to install and start 100 applications (including servers and GUIs)

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9. CHARA software upgrade To ubuntu 22

Currently we are using Ubuntu 16 LTS (support ended Apr 2021)

- A straightway upgrade of computers will not work as we need to upgrade software of cameralink and DM computer software
- Recent version of Matrox and Bitflow frame grabber software support the Ubuntu 22 LTS. We need to buy license to upgrade them.
- The rest of them are easier but we need to install in one compute and test.

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