Magellan Telescopes at Las Campanas Observatory

https://www.lco.cl

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EURECA
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Magellan Instruments

Magellan 1 – **Baade** Telescope

- ✓ **IMACS**, wide-field imager and multi-object spectrograph.
- ✓ **FourStar**, wide field near-infrared camera.
- ✓ **FIRE**, moderate resolution near-infrared echellette.
- **MagE**, moderate-resolution optical echellette.
- **LLAMAS**, upcoming MIT's IFU (will be commissioning soon). P.I. instrument

Magellan 2 – **Clay** Telescope

- **MIKE**, high-throughput double echelle spectrograph. optical.
- ✓ **LDSS3**, high efficiency, wide-field multislit spectrograph.
- **MEGACAM**, large mosaic CCD camera with a 24′ x 24′ field-of-view. *It won't be scheduled unless, there are > 5 nights successfully requested among the partners*
- **M2FS**, the Michigan/Magellan Fiber Spectrograph is a P.I. instrument.
- **IFUM**, Michigan's IFU that works on the M2FS platform (commissioning). P.I. instrument
- **MagAOX**, an experimental coronagraphic extreme adaptive optics system. P.I. instrument

Other Instruments

- **PFS**, the Planet Finding Spectrograph. P.I. instrument
- **PISCO**, simultaneous multi band visible imager. P.I. instrument
- **WINERED**, Japanese warm infrared echelle. P.I. instrument
- **POETS**, Portable Occultation, Eclipse, and Transit System. P.I. instrument, MIT

FIRE

The Folded port InfraRed Echellette (FIRE) spectrograph

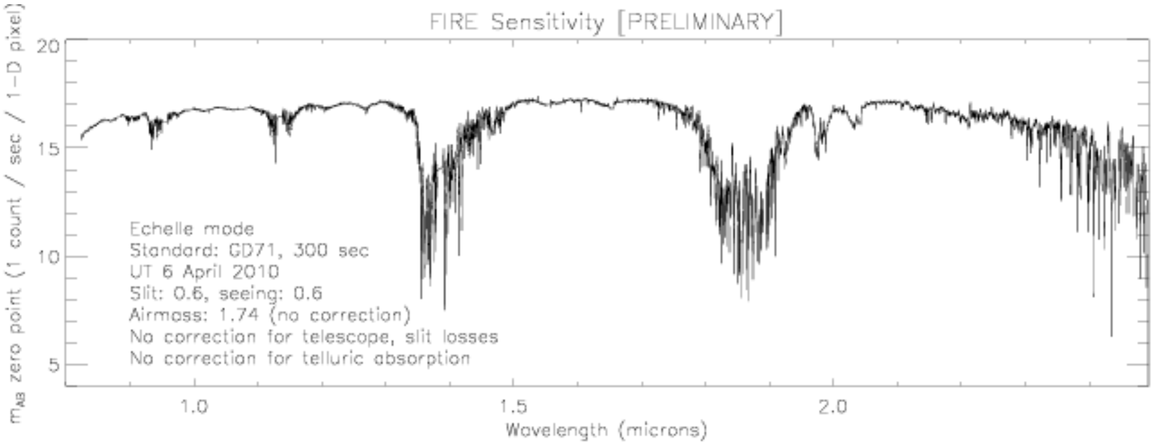
0.82-2.51 micron

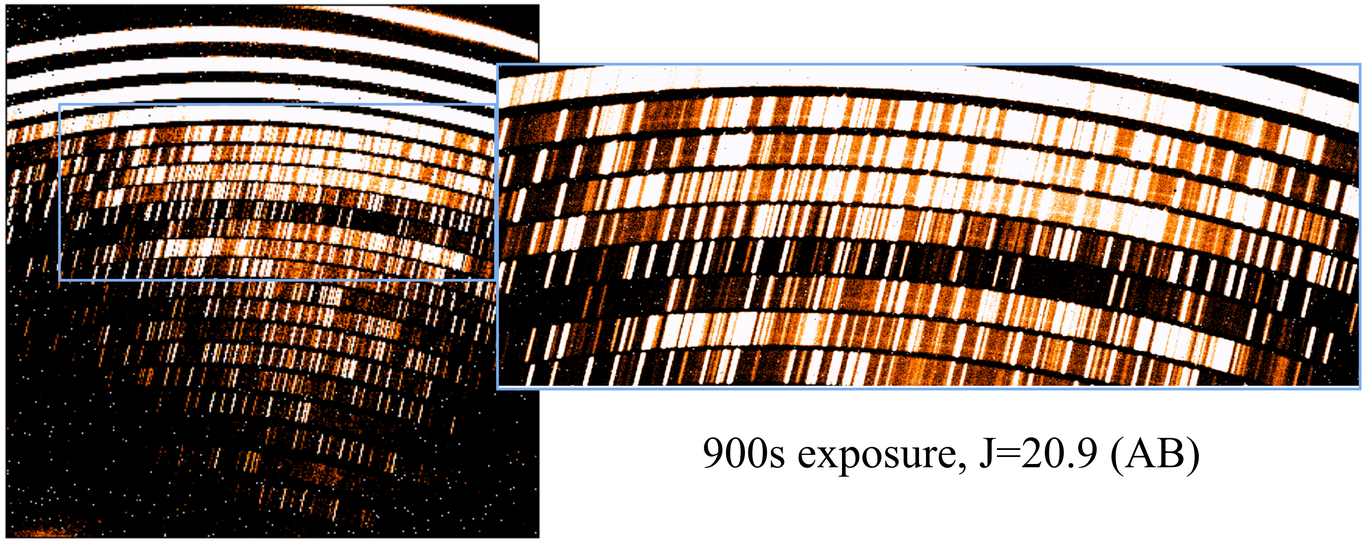
https://www.lco.cl/magellan-instruments/fire-observing-manual-local/

http://web.mit.edu/~rsimcoe/www/FIRE/observers.htm

Echelle

R = 6000 a 0.60" slit

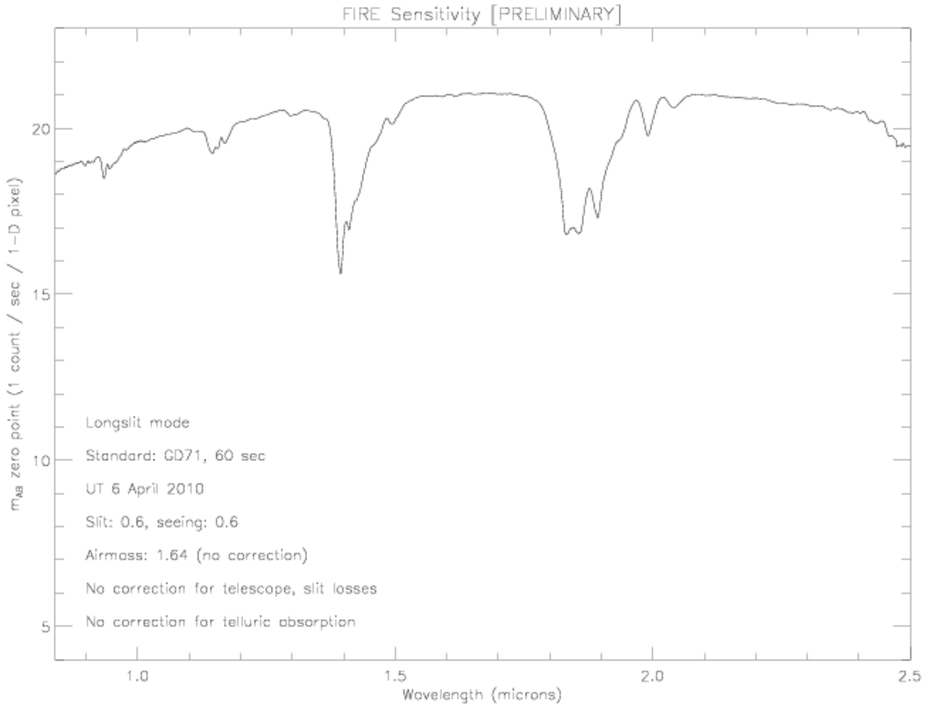


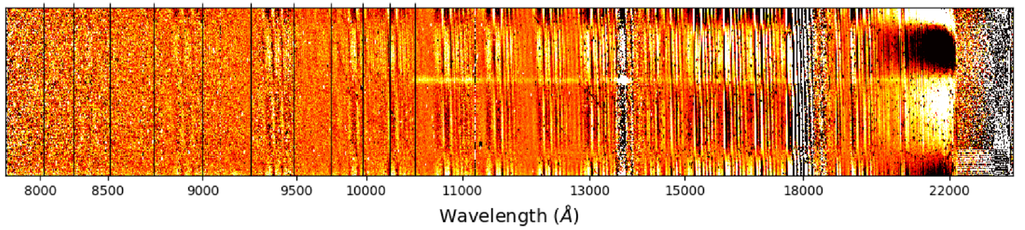


900s exposure, J=20.9 (AB)

Longslit

R = 500 a 0.60" slit in J band





600s exposure

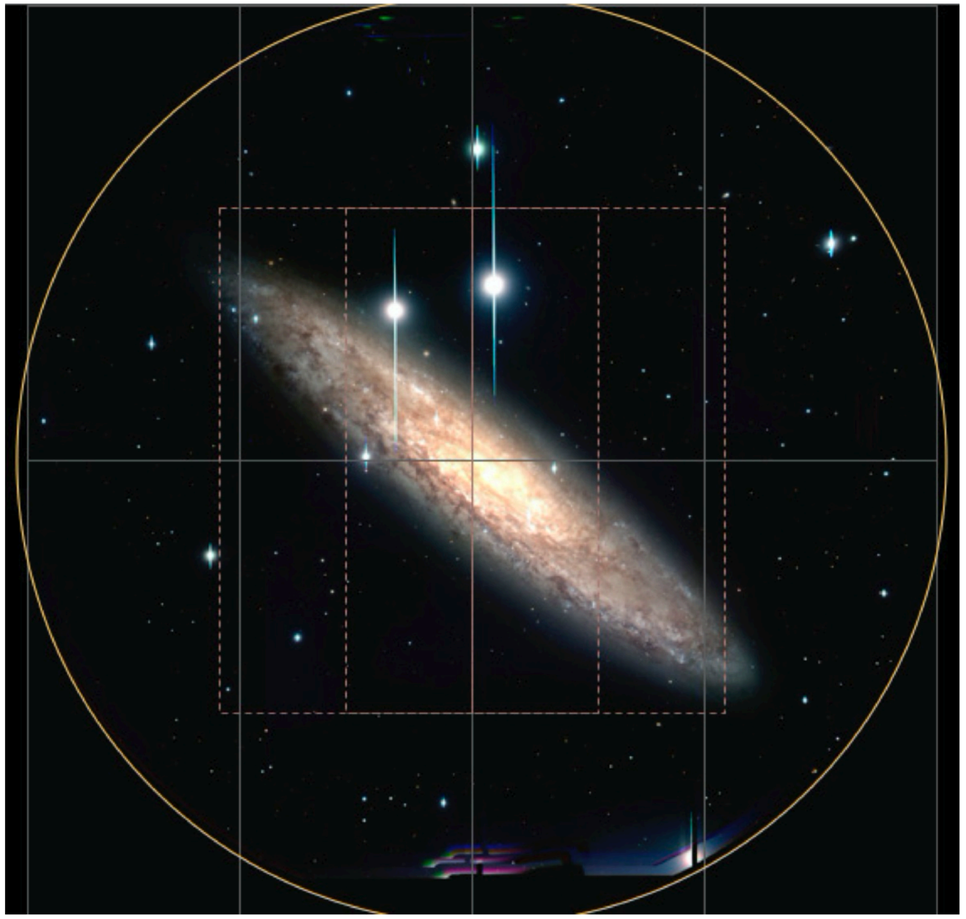
IMACS

The Inamori Magellan Areal Camera and Spectrograph

Imaging, long-slit, multislit spectroscopy

https://www.lco.cl/?epkb_post_type_1=imacs-user-manual

f/4 - 15.4 x 15.4 arcmin, 0.11"/pixel;
f/2 - 27.4 arcmin diameter, 0.2"/pixel



Gratings available for the f/4 channel

Grating (lines/mm)	Blaze Angle (degrees)	Order	Central Wavelength (Angstroms)	Wavelength Range (Angstroms)	Dispersion (Angstroms/pixel)
150	3.4	1	7550	3650-9740	1.453
300	4.3	1	6650	3650-9740	0.743
600	8.6	1	5180	3650-6750	0.378
600	13.0	1	8410	6480-10000	0.387
1200	17.5	1	4440	3650-5230	0.194
1200	26.7	1	7200	6500-8000	0.188
1200	26.7	2	4040	3650-4350	0.096
1200	32.2	1	8200	7500-9000	0.191

* IMACS Multi-Object Echelle (f/4)

Grisms available for the f/2 channel

Grism (lines/mm)	Blaze Angle (degrees)	Order	Central Wavelength (Angstroms)	Wavelengh Range (Angstroms)	Dispersion (Angstroms/pixel)
150	10.8	1	7200	5000-9000	2.630
200	15.0	1	6600	5000-9000	2.037
300	17.5	1	6700	3900-8000	1.341
300	26.7	1	8000	5000-9000	1.25
400*	21.2	1	4730	3900-8500	0.9

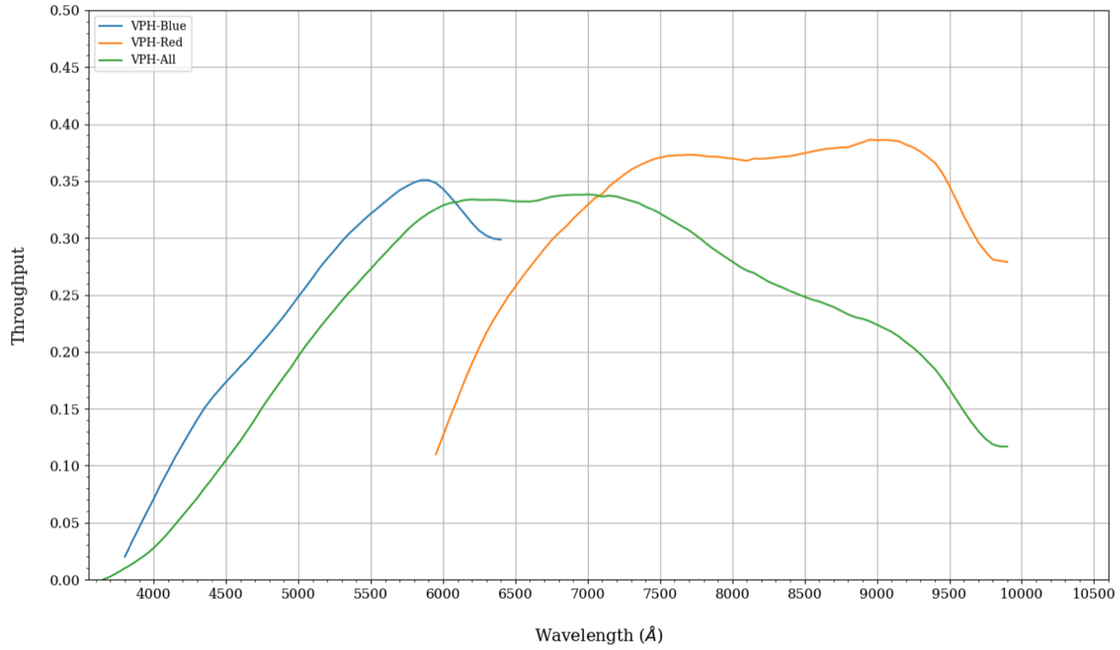
LDSS3

The Low Dispersion Survey Spectrograph

Imaging, long-slit, and multi-aperture mask

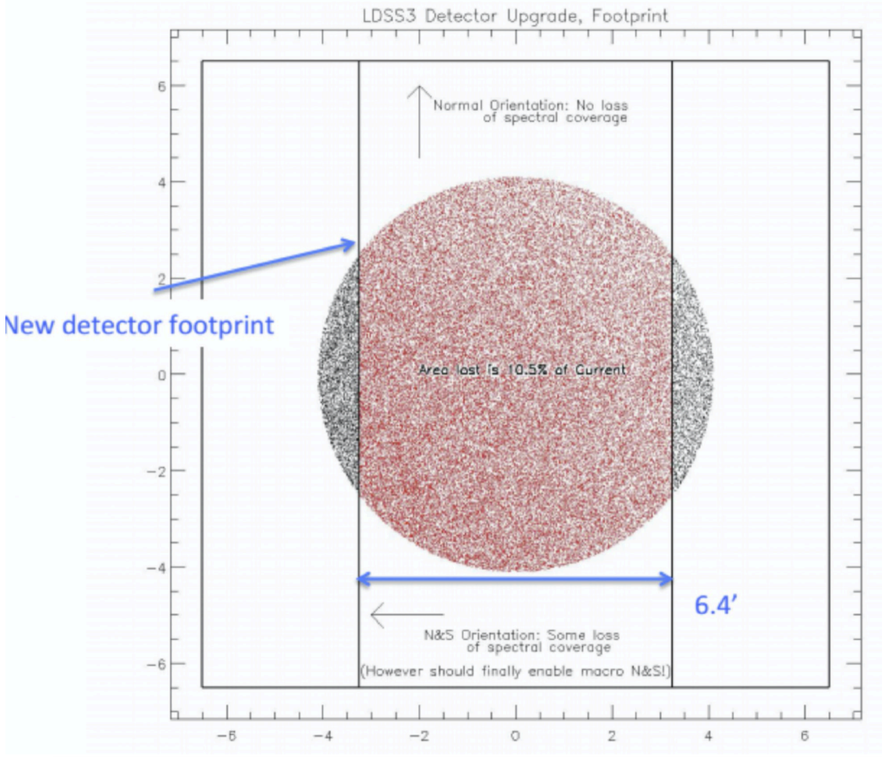
https://www.lco.cl/?epkb_post_type_1=ldss-3-user-manual

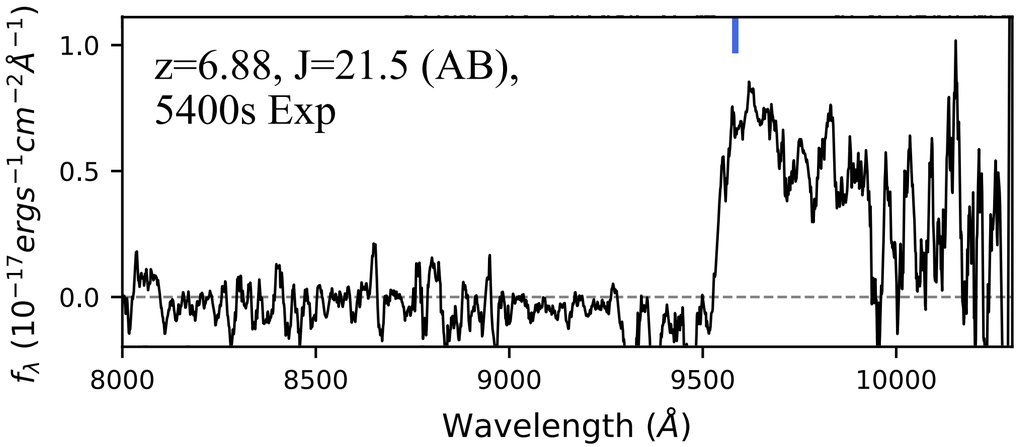
Grism	Lines mm-1	Resolution (0.75″ slit)	Central wavelength (A)	Nominal wavelength range (A)	Linear dispersion at nom.wav. range (A/pixel)	Peak total system efficiency (%)*
VPH-All	400	860	7100	4250 – 10000	1.890	34
VPH-Blue	1090	1900	5000	3800 – 6200	0.682	35
VPH-Red**	660	1810	8000	6000 – 10000	1.175	38



Higher efficiency than IMACS spectroscopy at red side

FOV 8.3’, but trimmed to 6.4’

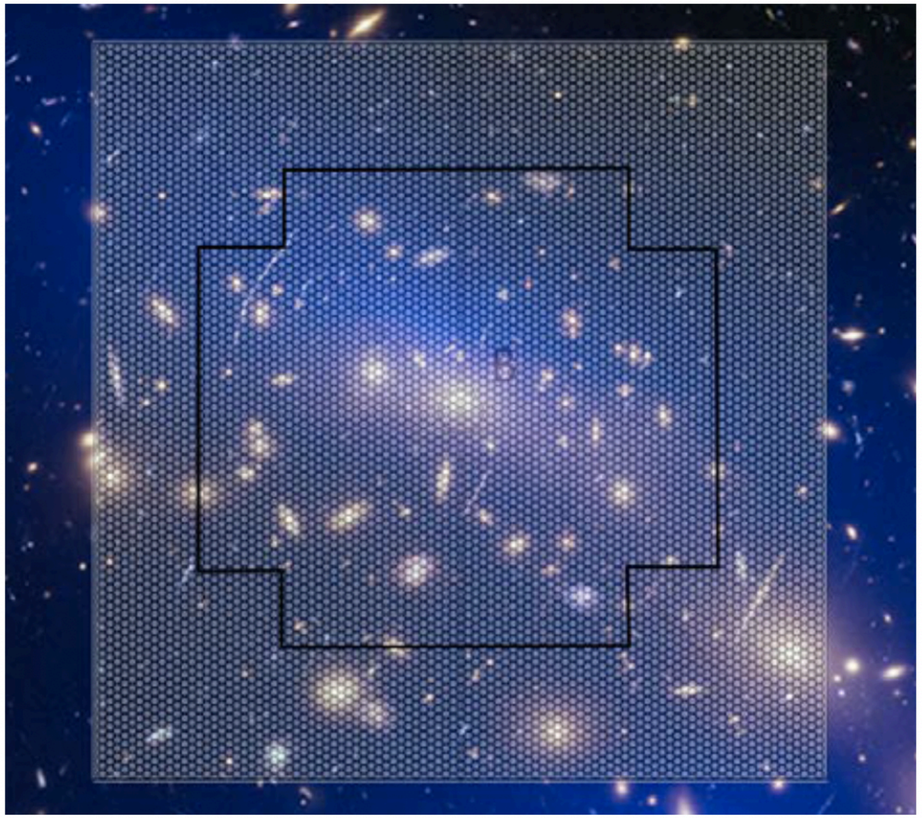




LLAMAS

The Large Lenslet Array Magellan Spectrograph (PI: R. Simcoe)

Design Parameter	LLAMAS (MRI scope)	LLAMAS (Full scope)
Lenslet pitch	0.75”	0.75”
Lenslet fill factor	≥ 93%	≥ 93%
Field of View (MRI Scope)	40” x 36”	60” x 60”
Wavelength Coverage	360-970 nm	360-970 nm
Spectral Resolution	R = 1300	R = 1300
Red / Blue Dichroic split	570 nm	570 nm
Telescope port	Aux Nasmyth (between elev. bearings)	Aux Nasmyth (between elev. bearings)
Availability	365 nights / year	365 nights / year
Sensors	Two 2048x2048, red deep depl.	Two 2048x2048, red deep depl.
Modes	Full frame, nod-and-shuffle	Full frame, nod-and-shuffle
Fiber run	4.5 meters Polymicro FPBI	4.5 meters Polymicro FPBI
# Spectrographs	8	24
# Fibers	2560	7680



from LLAMAS pocket guide

M2FS & IFUM (PI: Mario Mateo)

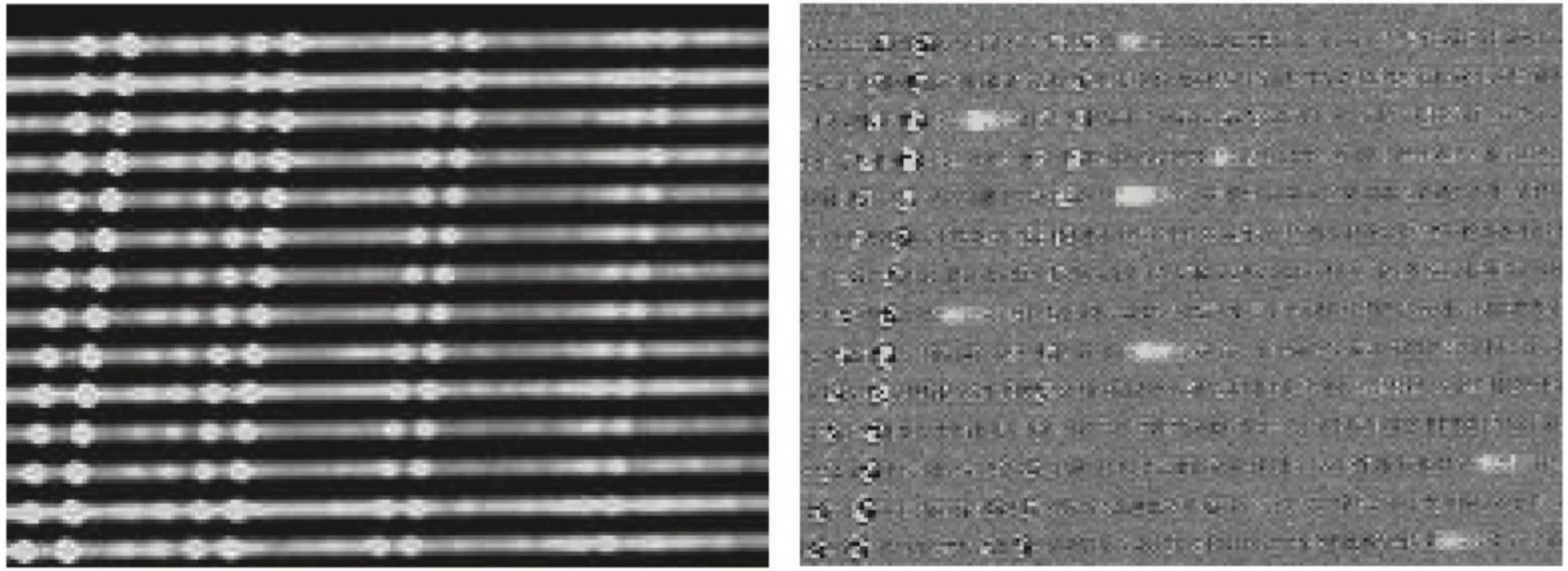
Michigan/Magellan Fiber System

Integral Field Units for Magellan

M2FS

Property	M2FS	
	HiRes	LoRes
Channels	2	2
# of Fibers	256	256
λ Range (*nm*)	370-950	
Resolution, R	18-34*k*	0.2-10*k*
X- Dispersed?	Yes	No
Fiber Diam.	1.2”	
Min. Fiber Sep.	12”	
Field Diam.	30 *arcmin*	
V_{limit}: S/N=5, 2 *hrs*, 500 *nm*, med. Seeing	21.5 R~20*k*	24.0 R~20*k*

Mateo et al. 2012



5-6 hours one-source integration time allows detection of LAEs at z~6 with a Lyα flux of $\sim 1 \times 10^{-17}$ erg s^{-1} cm^{-2} (Jiang et al. 2017).

M2FS & IFUM (PI: Mario Mateo)

Michigan/Magellan Fiber System
Integral Field Units for Magellan

Three fiber-optic IFUs
HR (high-resolution), STD (standard-seeing) and LSB (lowsurface brightness)

Mateo et al. 2022

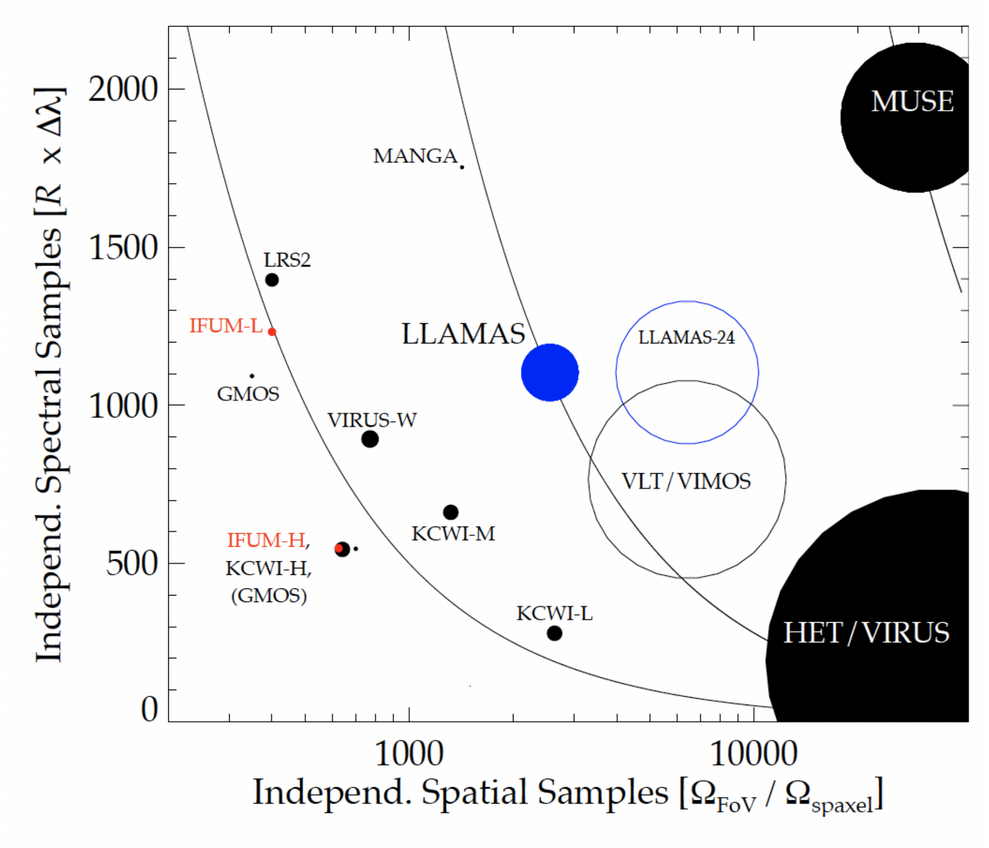
IFUM

370-950 nm

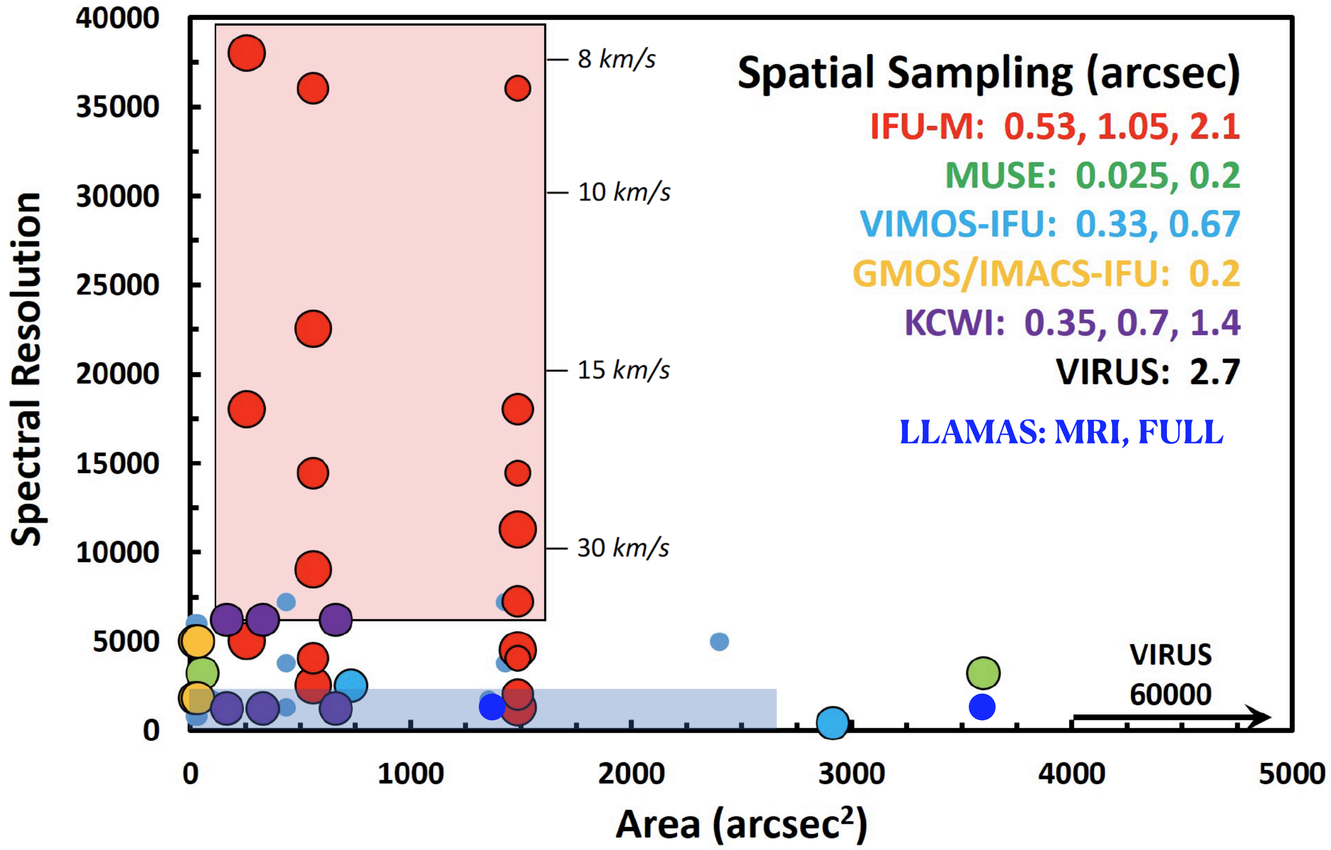
Property	HR	STD	LSB
Array Size (*arcsec*)	13.9 × 14.2	23.9 × 21.6	32.7 × 31.4
Array Format (# of fibers)	27 × 32 (864)	23 × 24 (552)	18 × 20 (360)
Spaxel Diameter (*arcsec*)	0.54	1.09	1.90
Spaxel Diameter (*mm*)	0.51	0.62	0.99
Fiber Core Diameter (*microns*)	75	150	260
IFU Covering Factor (Note 1)	91%	93%	97%
Field area ($arcsec^2$)	197	516	1027
Barlow Lens f/ratio	30.0	18.0	16.5

IFU Designation:		LSB	STD	HR
Occultors (diam, **arcsec**):		2.0, 3.0	1.5, 2.6	1.0, 2.0
Slits (microns):		260, 175, 80	150, 80	75
Resolution:	LoRes	1000, 4000	2000, 3500	5000
	MedRes	4000, 7000, 15000	8000, 14000	18000
	HiRes	12000, 22000, 36000	22500, 36000	38000
Sensitivity:	LoRes	23.5 (24.7)	22.3 (22.1)	21.0 (19.2)
(V-band)	MedRes	22.3 (23.5)	21.1 (20.8)	19.4 (17.6)
(5σ, 2 hrs)	HiRes	21.6 (22.8)	20.3 (20.0)	18.8 (17.0)

from IFU-M Capabilities summary



from LLAMAS pocket guide



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