

JOHN O'MEARA, CHIEF SCIENTIST, W.M. KECK
OBSERVATORY

SMALL BODY SCIENCE WITH KECK OBSERVATORY

COMMUNITY ACCESS TO KECK

- NASA is a 1/6th partner in Keck
- NOAO has some access starting 2021B
- Collaborations with UC/CIT/UH/others
- Archival data spanning 25 years

CURRENT CAPABILITIES

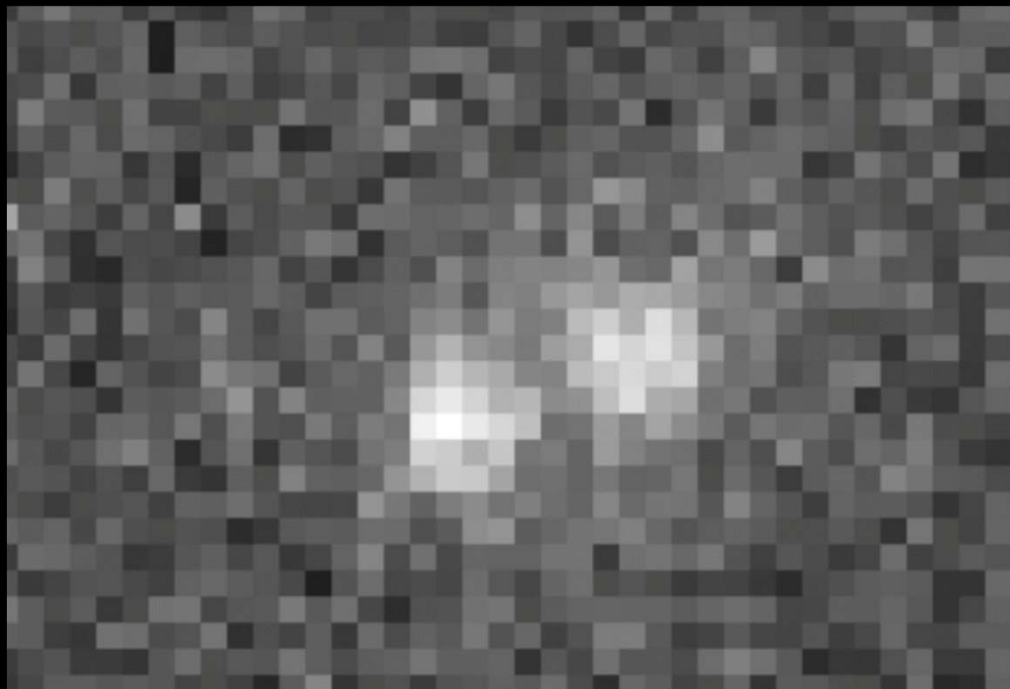
CURRENT INSTRUMENTATION

Instrument	Description	Band	Location
Keck I			
HIRES (1992) (High Resolution Echelle Spectrometer)	Single-slit high resolution spectrograph	Visible 3,000-10,000 Å	Nasmyth
LRIS (1993) (Low Resolution Imaging Spectrometer)	Single slit/multislit low resolution spectrograph & imager	Visible 3,000-10,000 Å	Cassegrain
MOSFIRE (2012) (Multi-Object Spectrometer For Infrared Exploration)	Single slit/multislit low resolution spectrograph & imager	IR: Z,J,H,K	Cassegrain
OSIRIS (2005) (OH Suppressing Infrared Imaging Spectrograph)	Medium resolution integral field spectrograph	IR: Z,J,H,K	Nasmyth, AO

Instrument	Description	Band	Location
Keck II			
DEIMOS (2002) (Deep Imaging Multi-Object Spectrograph)	Single slit/multislit low resolution spectrograph & imager	Visible	Nasmyth
ESI (1999) (Echelle Spectrograph and Imager)	Single slit medium resolution spectrograph & imager	Visible 4000-11000 Å	Cassegrain
KCWI (2017) (Keck Cosmic Web Imager)	Integral Field Spectrograph	Visible 3500-5500 Å	Nasmyth
NIRES (2017) (Near Infrared Echelle Spectrometer)	Infrared medium resolution spectrograph	IR: 0.94-2.45μ	Bent Cassegrain
NIRC2 (2001) (Near Infrared Camera)	LGS/NGS AO infrared imager	IR: 1-5μm	Nasmyth, AO
NIRSPEC (1999) (Near Infrared Spectrograph)	IR echelle spectrometer (Can be used with AO)	IR: 0.95-5.5μm	Nasmyth, AO, FIU

EXAMPLES

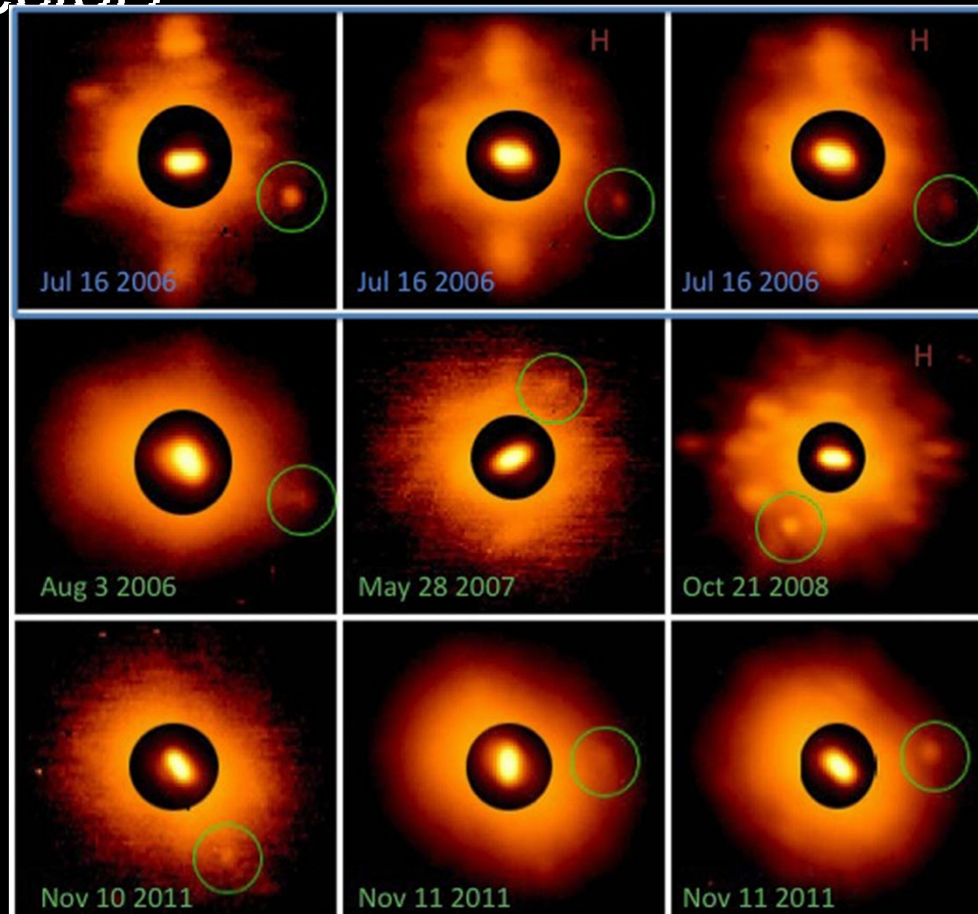
- NIRC2 + AO imaging of KBO binaries



W. Grundy

EXAMPLES

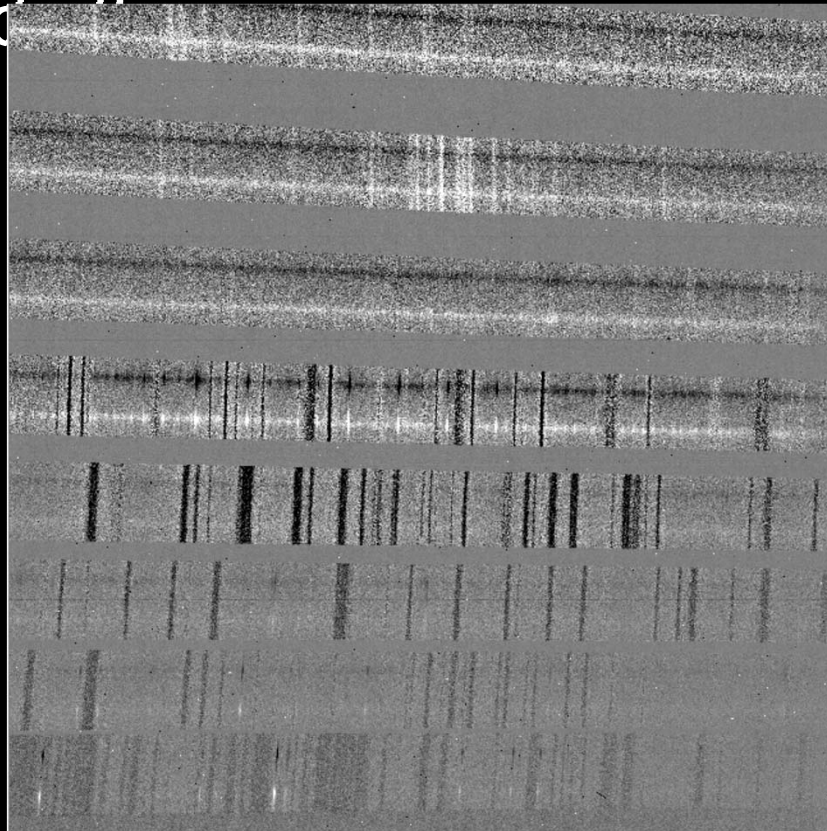
- LGS and NGS observations of Trojan binary asteroid system (Hector)



F. Marchis

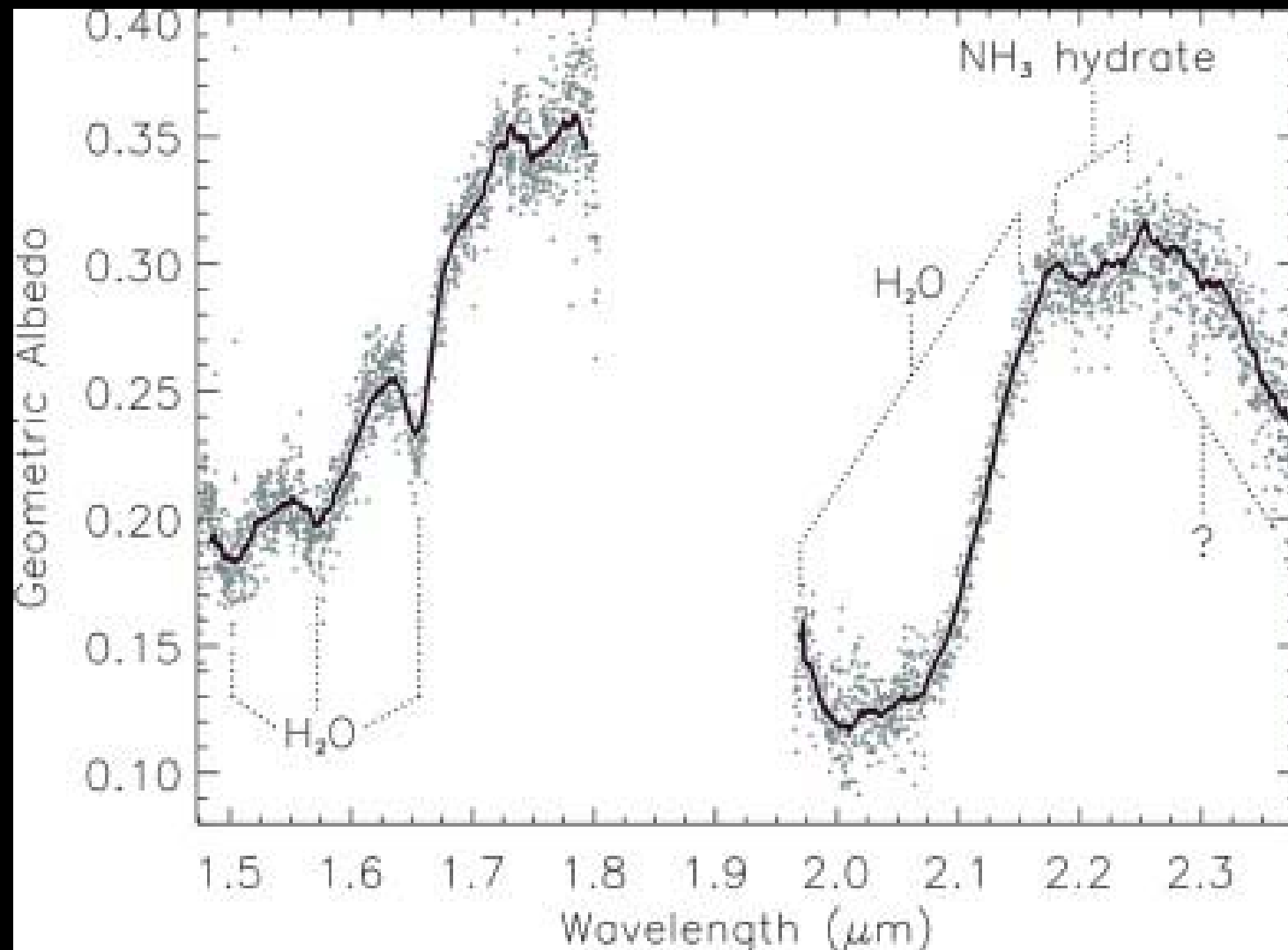
EXAMPLES

- NIRSPEC observations of Comets Wirtanen, NeoWISE and ...



M. Mumma

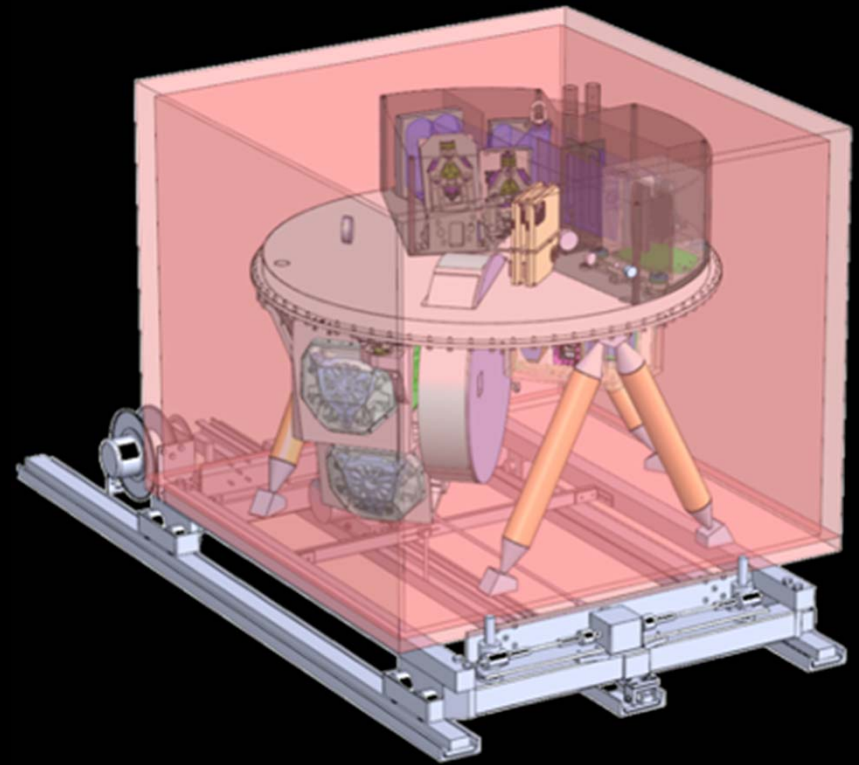
OSIRIS OBSERVATIONS OF CHARON



FUTURE CAPABILITIES

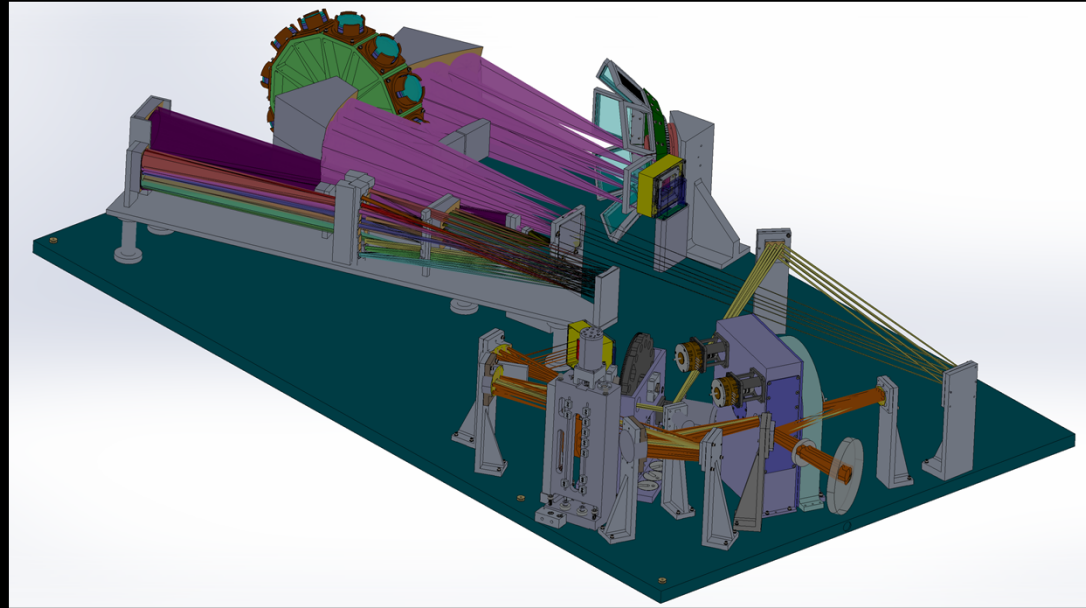
LIGER

- Second generation high spatial resolution IFU
- 0.8 - 2.5 μ
- Optimized for use behind KAPA AO

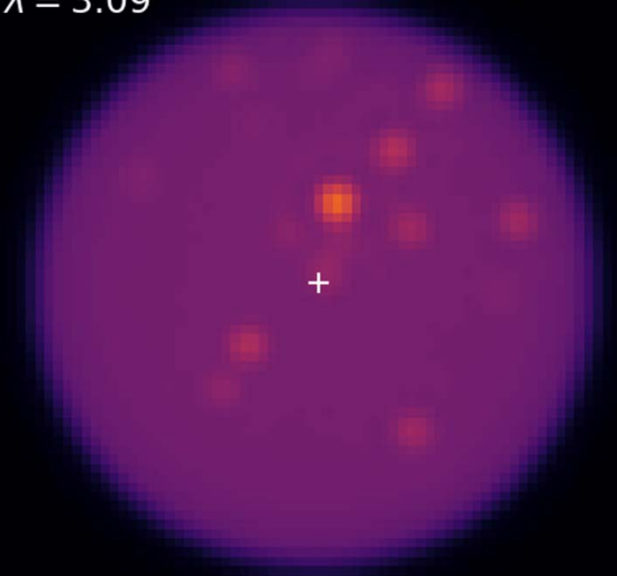


SCALES

- Thermal IR (2 - 5 μ)
- IFU and Imaging arms
- Behind AO
- Low to medium resolution spectroscopy
- First light in 2023

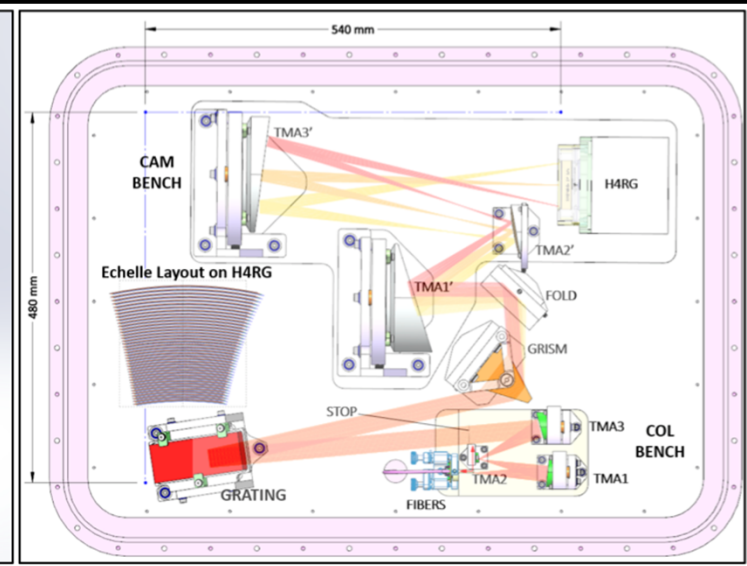
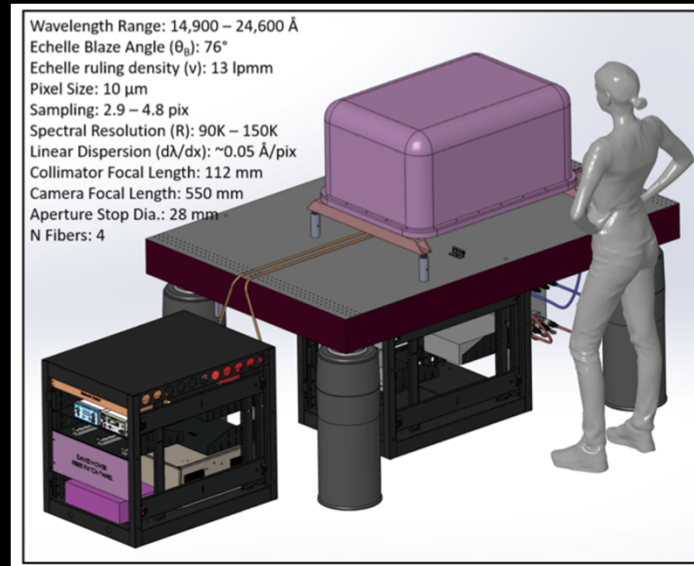


$\lambda = 3.09$



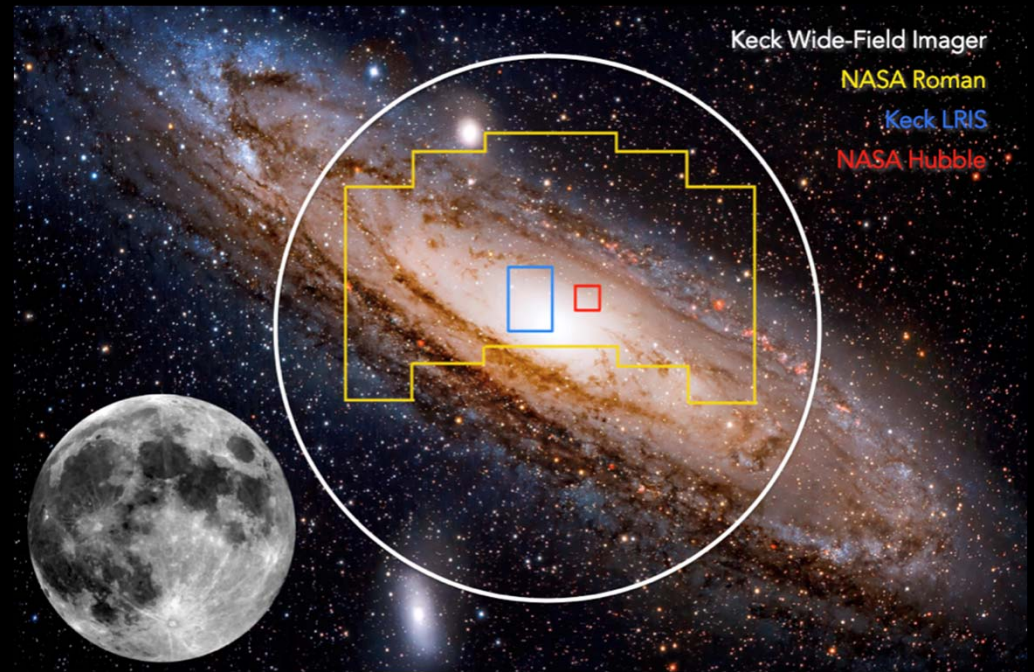
HISPEC

- $R > 100,000$
- 1.49 to 2.46 μ
- Behind AO
- Notional first light in Dec 2024 if awarded NSF MRI



THE KECK WIDE FIELD IMAGER

- Located at prime focus, will be the most powerful camera on the planet
- 1.4° diameter FOV
- $0.3 - 1\mu$
- Deployable secondary possible
- $(u,g,r,i,z) = 28.2, 28.7, 28.0, 27.0, 25.9$ in 2 hours



WIDE FIELD IMAGER

- Can perform a 100 degree survey per 9.5 hour night (including overheads) with 30 second exposures
- SNR 10-15 g and r band photometry of 1000s of Main Belt asteroids down to g,r ~26
- Detection of fragments down to 50m at ~1.5AU
- Detect 150km scale objects out to 100 AU in deep stacks

Time	u	g	r	i	z
30 sec	25.4	25.7	25.0	24.1	23.0
1 min	25.8	26.1	25.4	24.5	23.4
5 min	26.7	27.0	26.3	25.4	24.3
30 min	27.7	28.0	27.3	26.4	25.3

DATA SERVICES INITIATIVE

- End-to-end change in how Keck creates and serves data
- Keck-supported pipelines to allow real-time quicklook and short-time full processing of data, served to the archive within minutes to hours
- Stage one to be complete in CY23