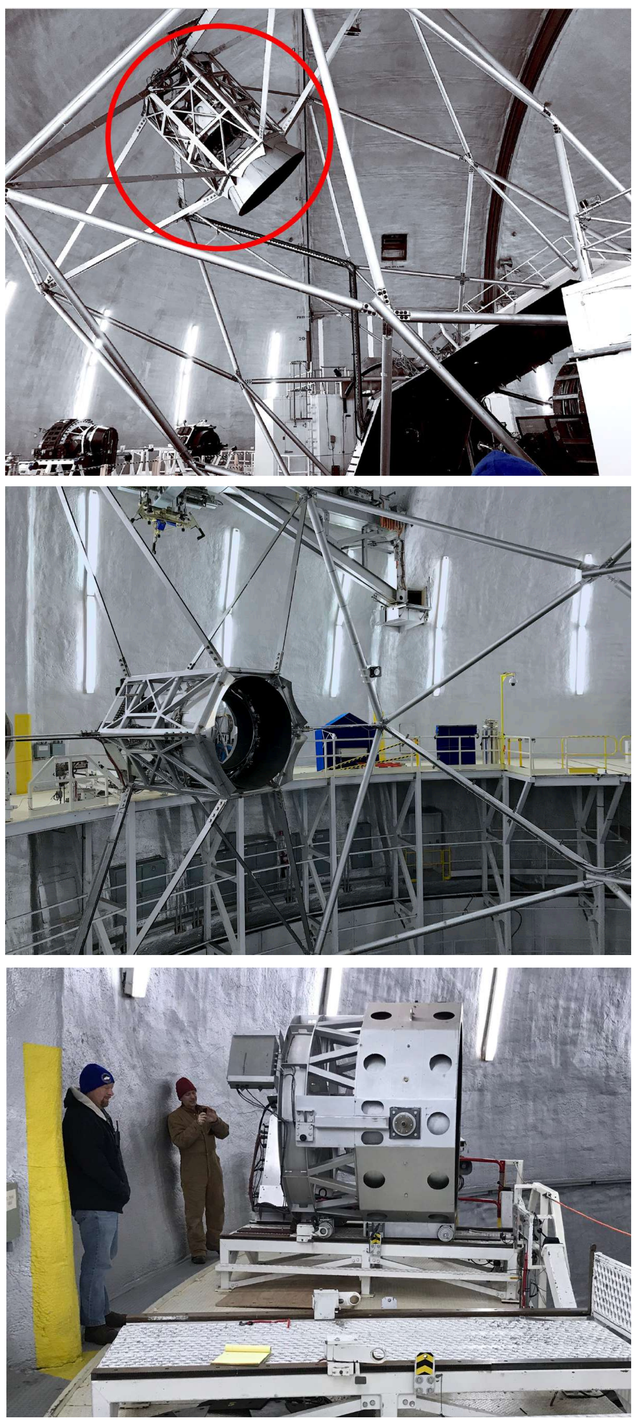
The Keck Wide-Field Imager

A UV-sensitive optical imager for Keck

The most powerful wide-field imager in the world for the foreseeable future



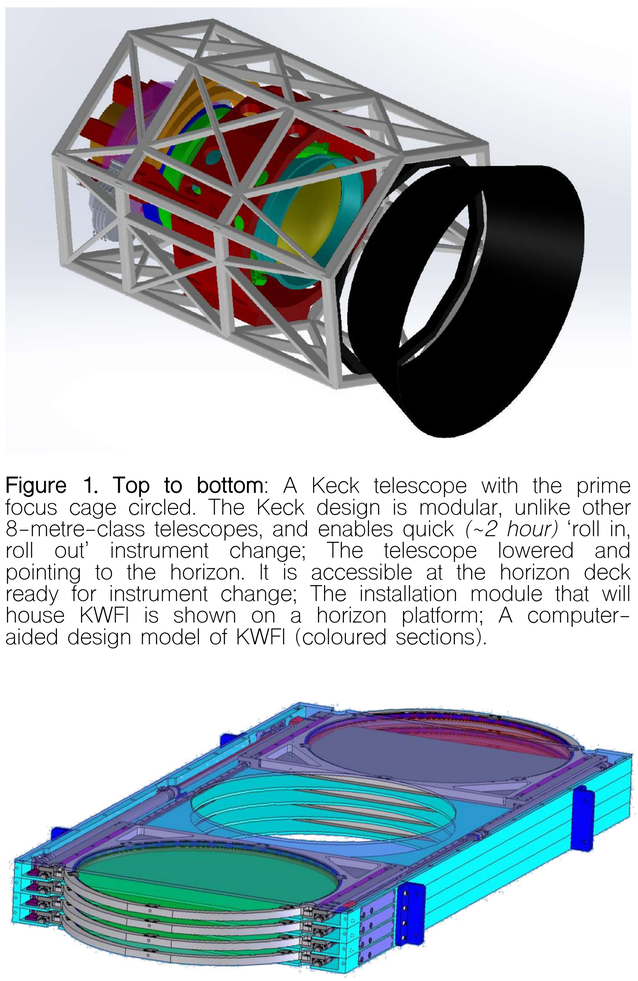


Figure 1. Top to bottom: A Keck telescope with the prime focus cage circled. The Keck design is modular, unlike other 8-metre-class telescopes, and enables quick *(~2 hour)* 'roll in, roll out' instrument change; The telescope lowered and pointing to the horizon. It is accessible at the horizon deck ready for instrument change; The installation module that will house KWFI is shown on a horizon platform; A computer-aided design model of KWFI (coloured sections).

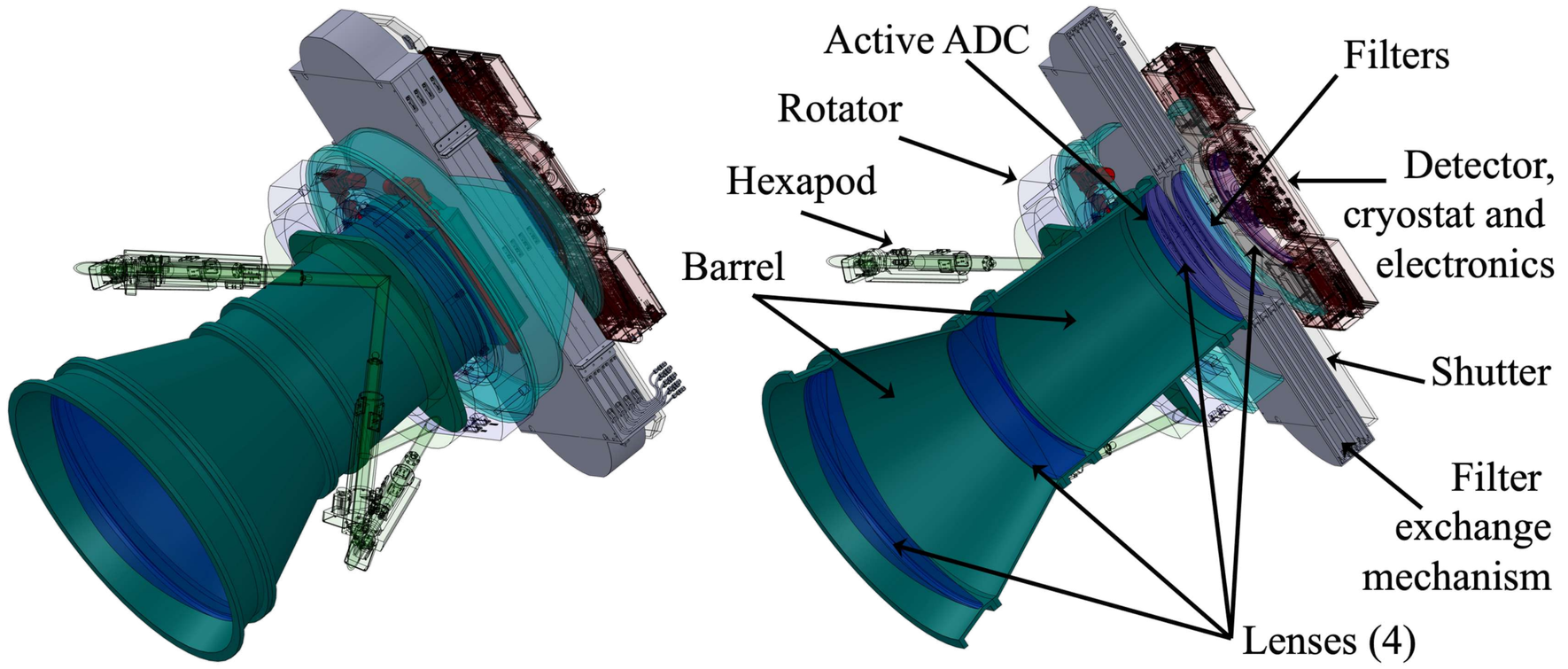
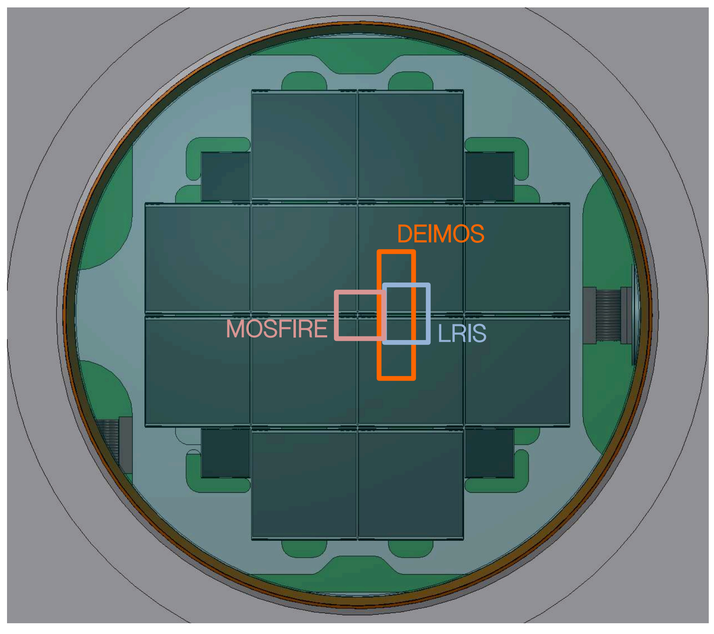
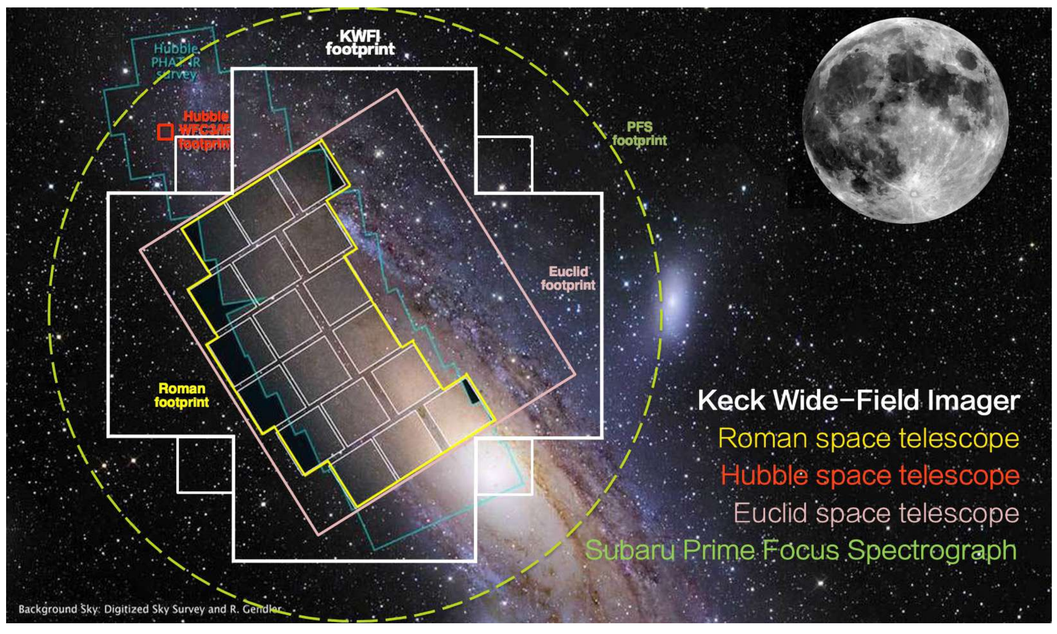


Figure 2. Computer-aided design model of KWFI. Left: KWFI with some components shown translucent for clarity. **Right:** Cut-away view of KWFI with some components labelled.





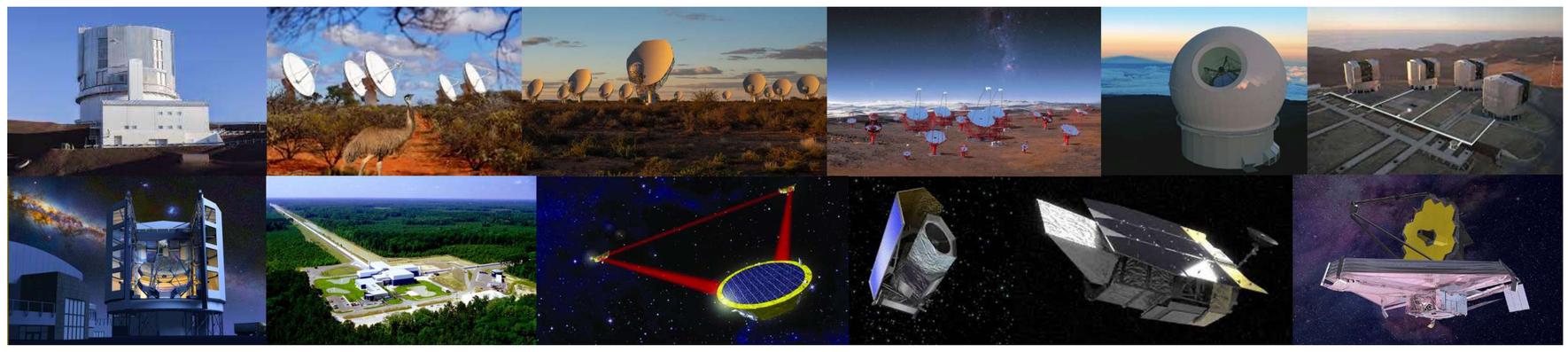


Figure 3. Top left. One detector format for KWFI. Twelve 6Kx6K CCDs in a Swiss cross pattern, with CMOS detectors on the four corners for focus, guiding and science. **Top right:** KWFI field of view compared to some existing and upcoming wide-field facilities. **Bottom:** Most facilities built over the last two decades and upcoming facilities have wide-field or all-sky capability. KWFI is needed for facilities operating at all wavelengths, particles, and gravitational waves to help achieve their main science aims and extend their reach. KWFI will excel at source localisation, host galaxy properties, and detection of faint, rare, and lensed sources for facilities such as *(left to right, top to bottom)* Subaru and the Prime Focus Spectrograph, the Square Kilometre Array (SKA) and SKA pathfinders ASKAP and MeerKAT, Cherenkov Telescope Array (CTA), Maunakea Spectroscopic Explorer, Thirty Meter Telescope, Giant Magellan Telescope, LIGO/Virgo/KAGRA and space-based LISA gravitational wave detectors, Euclid, Roman, and James Webb Space Telescopes.

Figure 4. Top: The KWFI filter exchanger is based on the successful Dark Energy Camera (DECam) design and will have ~10s filter exchanges. **Bottom:** KWFI filters are designed to be the same size as Subaru Hyper Suprime-Cam. As a result, a potential collaboration will enable broadband, narrow-band, and specialized filters to be shared between the observatories.

Some KWFI specifications and applications

- 1-degree diameter field of view
- CCD resolution: 0.145'' per pixel, ~10s readout, ~2 min data reduction
- Room for 8 filters at any one time, ~10s filter exchange
- CMOS chips: sub-second exposures, can be used for science
- Minutes-later spectroscopic multiplexing with deployable secondary mirror
- Sensitivity: m ~ 29 and 30, including the u-band (see table below)
- Can detect and map faint Lyman continuum emission for cosmic reionisation
- Provides crucial very deep blue photometry for accurate phot-zs and Roman main science
- Rapid ToO capability, will get > 90% of all missed kilonovae from current and future GW facilities
- The only imager that can get fast-evolving (and poorly localised) faint extragalactic transients

Time	u	g	r	i	z
5 min	26.7	27.0	26.4	25.7	24.9
30 min	27.7	28.0	27.4	26.7	25.9
2 hr	28.4	28.8	28.1	27.4	26.6
20 hr	29.7	30.0	29.4	28.7	27.9

5 sigma depths, 0.8" FWHM seeing, 3 days from New Moon

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