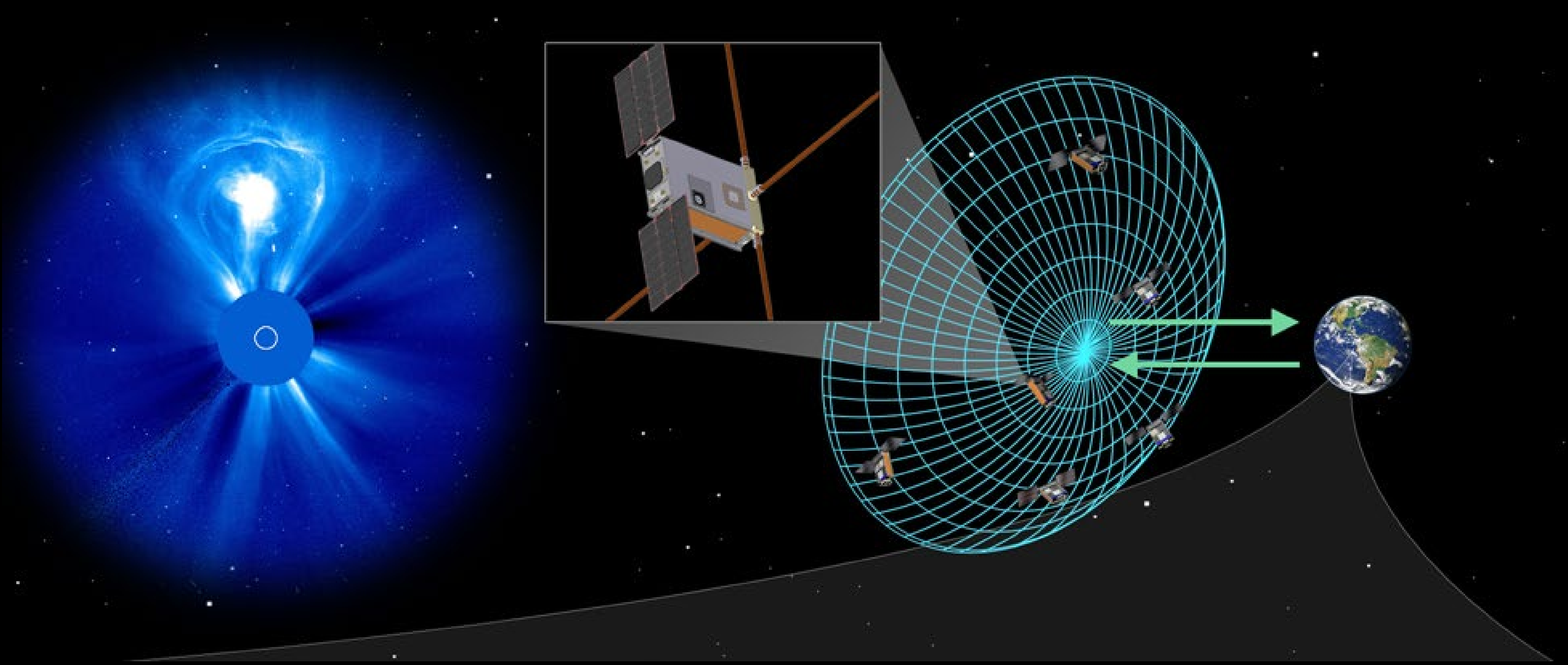
Sun Radio Interferometer Space Experiment (SunRISE)



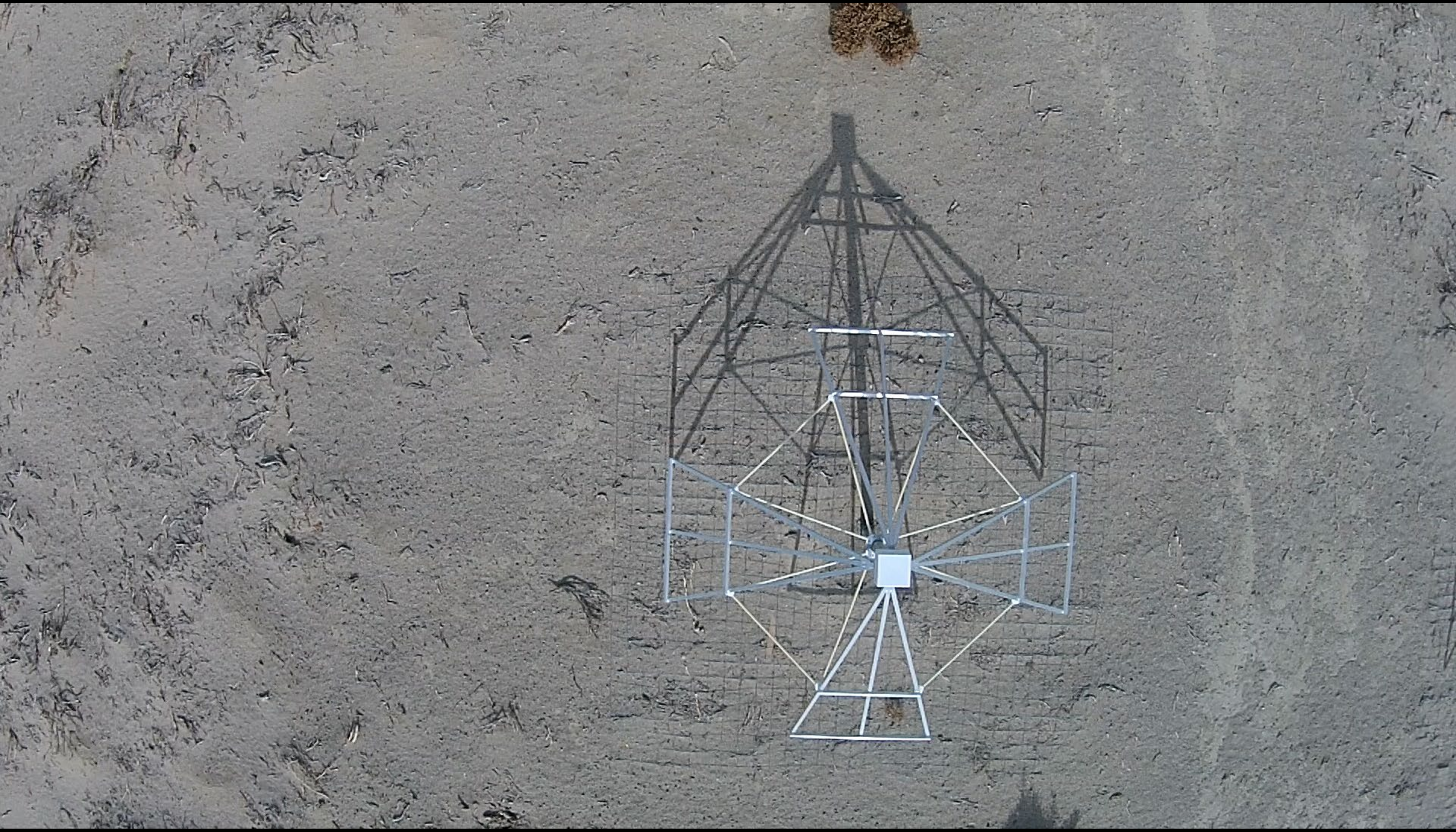
Loose formation of six 6U form factor smallsats in 10 km sphere

Radio receiver (0.1 – 20 MHz) with crossed 5 m dipole antennas

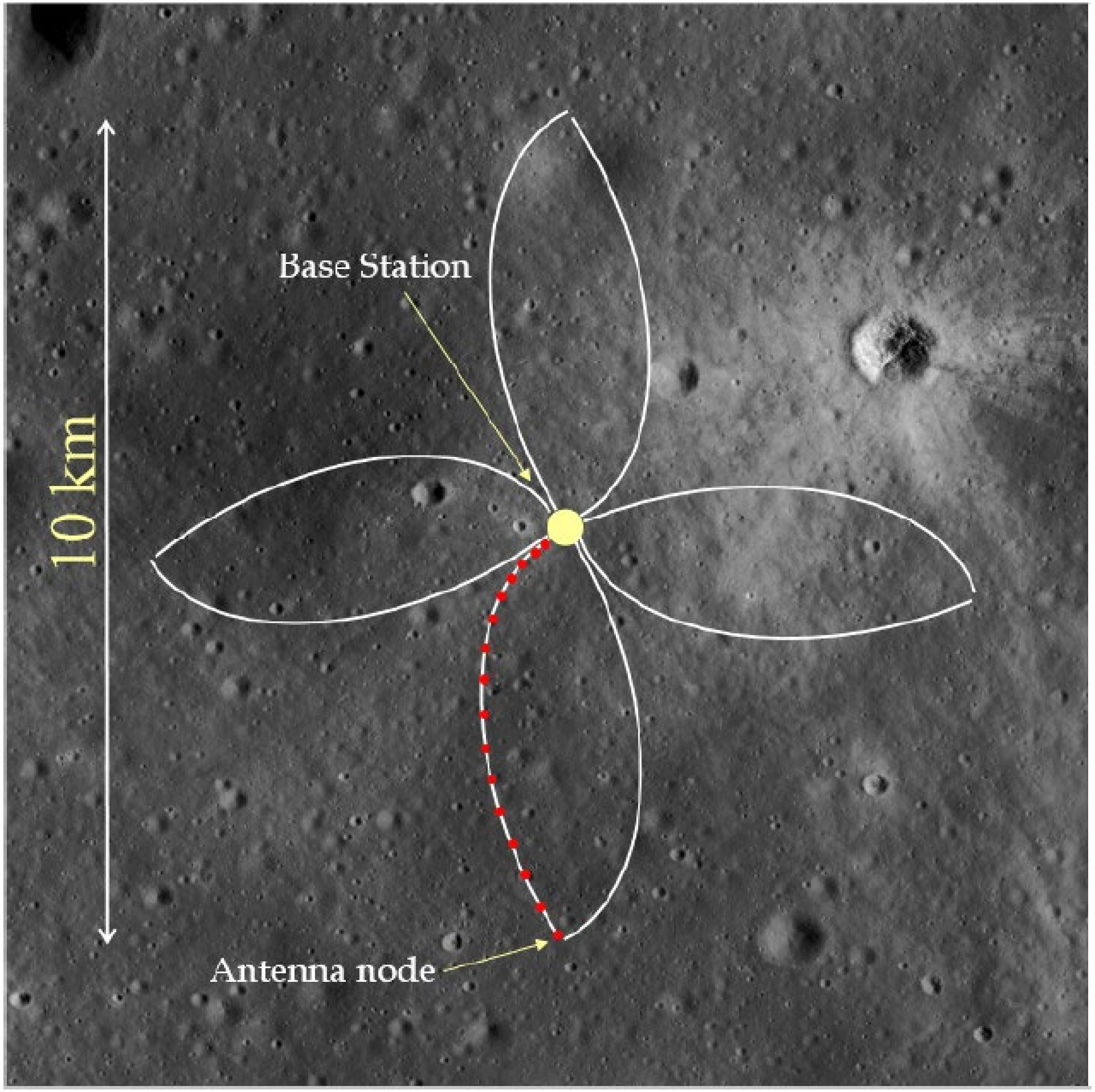
Currently in Extended Phase A Study

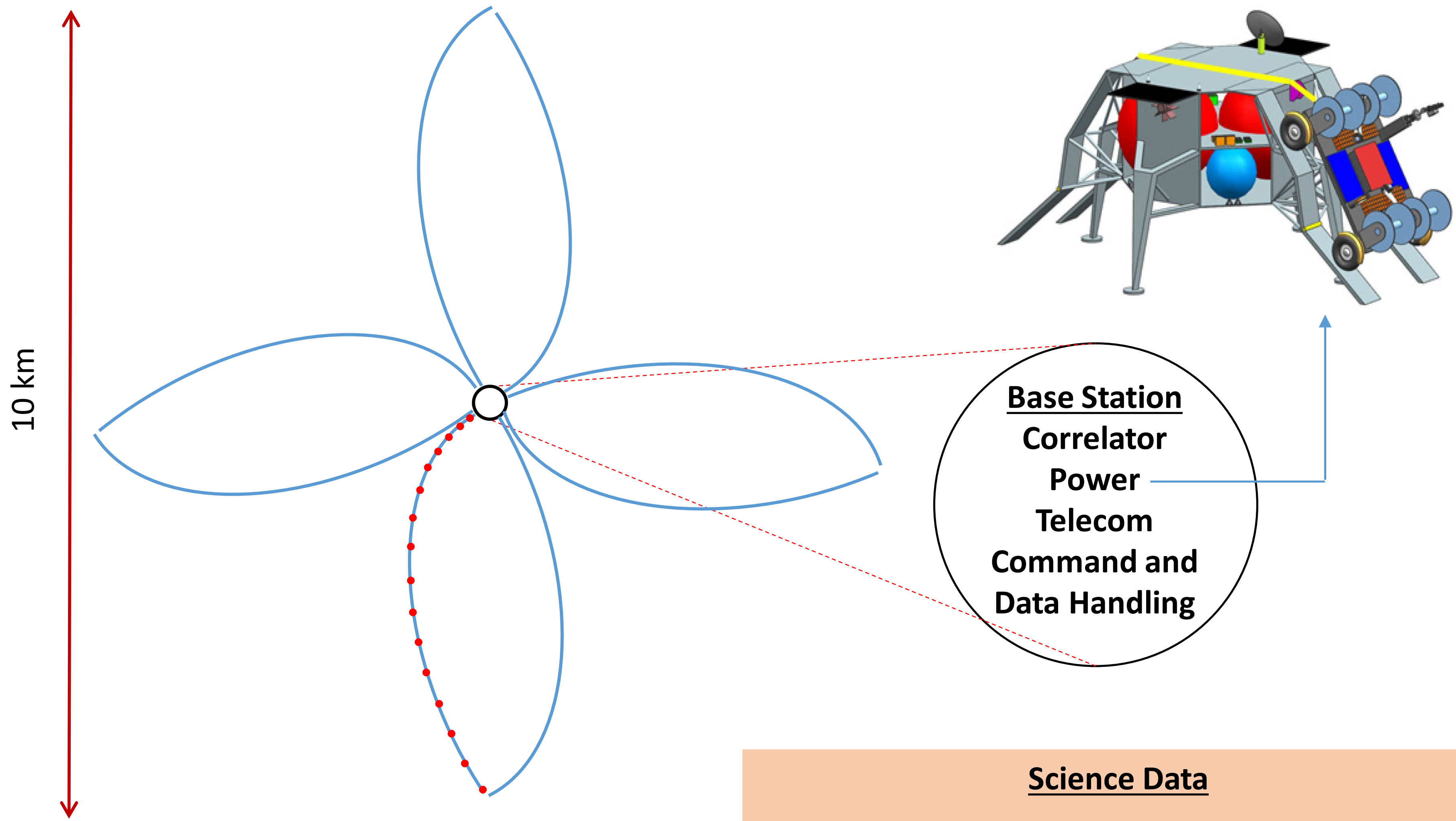
Courtesy of Justin Kasper & Joe Lazio

The OVRO-LWA



FARSIDE Configuration





128 antennas total

Arranged in a “petal” configuration

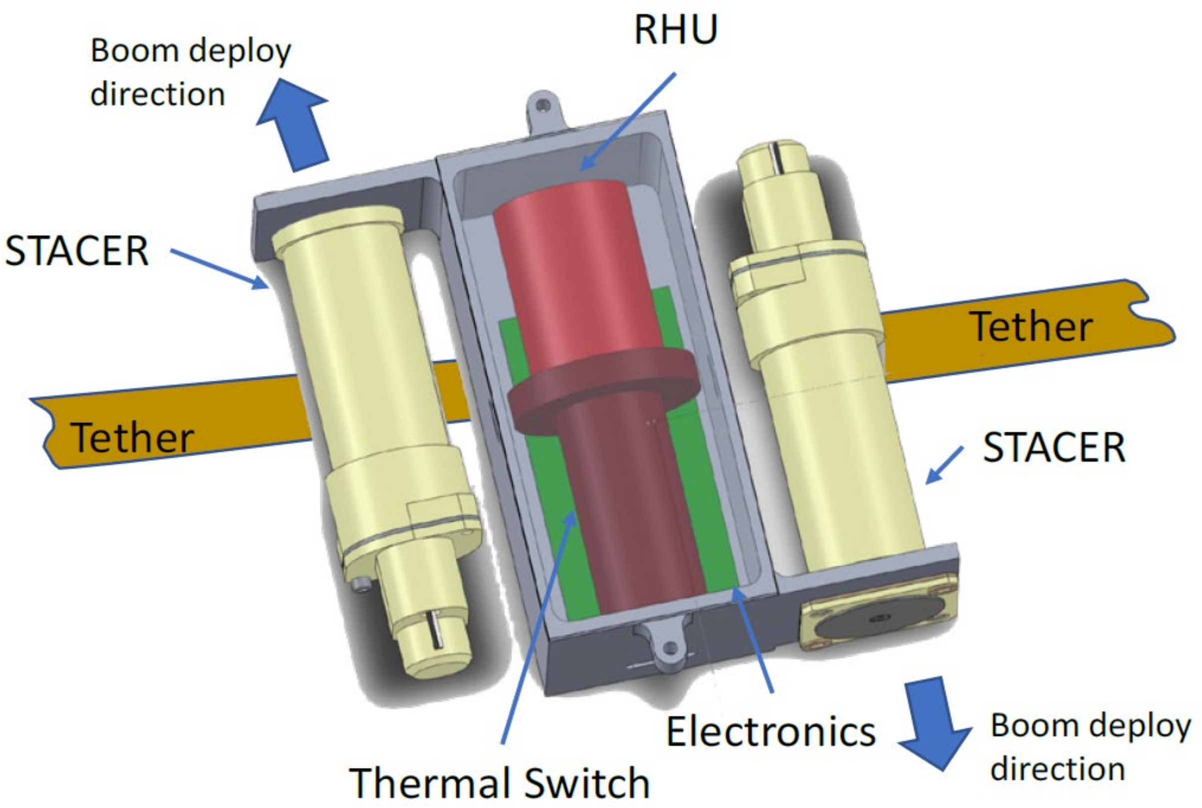
16 antennas per spoke (20 kg)

Calibration via orbiting beacon

Science Data

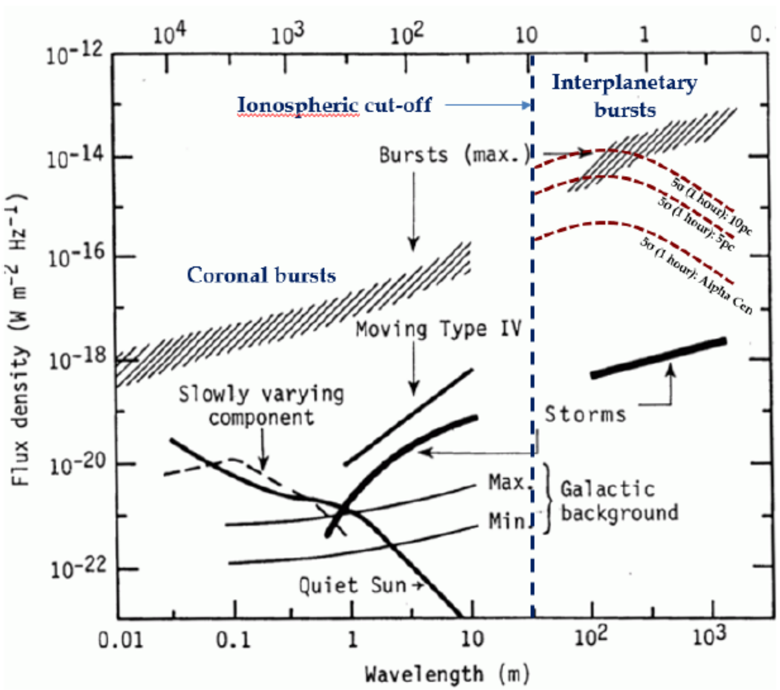
Frequency range: 0 – 25 MHz (1400 channels)
Integration time: 60 s
All visibilities: 65 GB/day
All-sky imaging every 60 seconds (Stokes I and V)
Deep all-sky imaging every lunar day

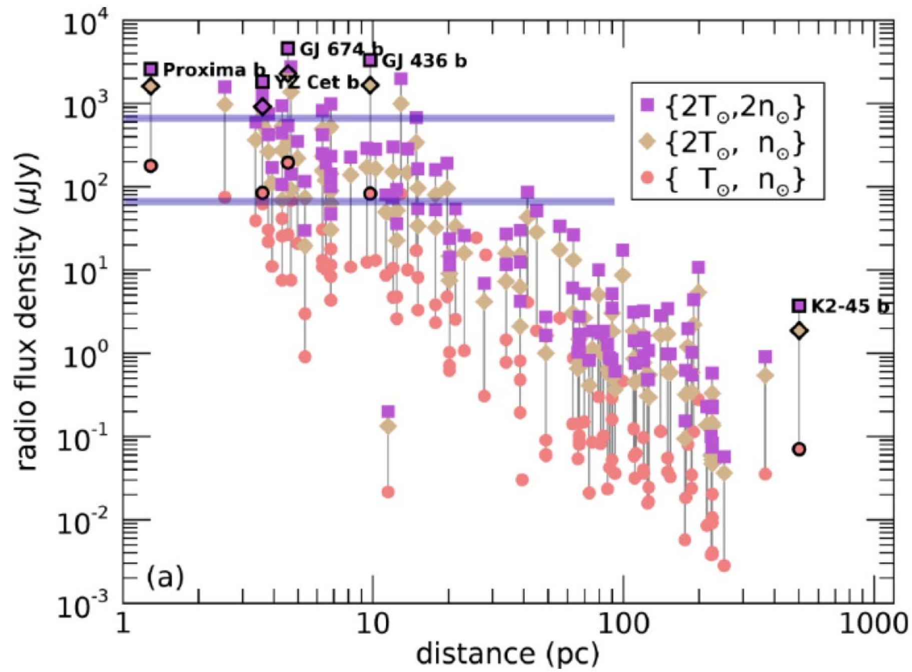
FARSIDE Antenna Node



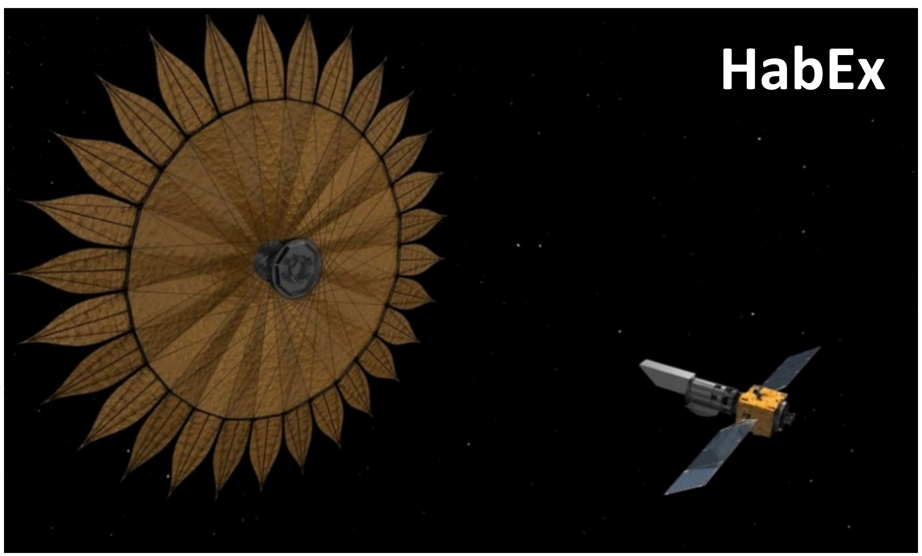
OVR

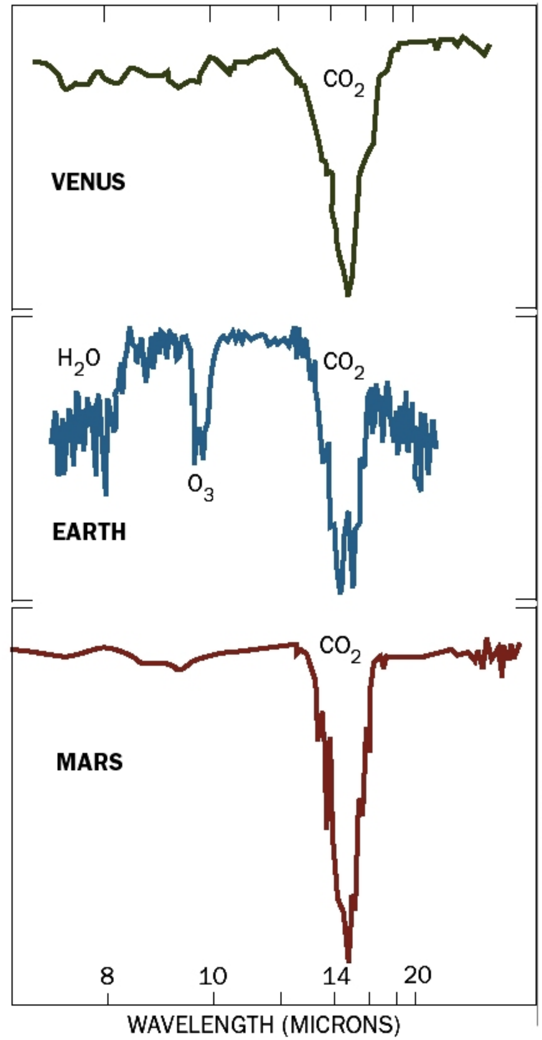
l. 2018

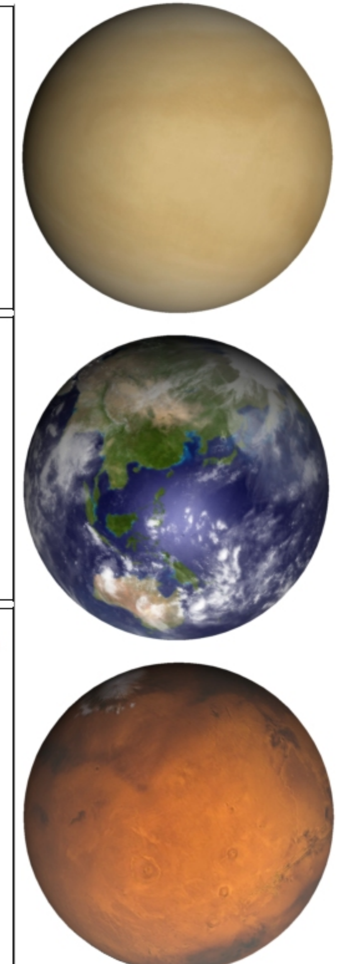

Ionospheric cut-off
Interplanetary bursts
Bursts (max.)
Coronal bursts
Moving Type IV
Slowly varying component
Storms
Max
Min
Galactic background
Quiet Sun
Flux density (W m^{-2} Hz^{-1})
Wavelength (m)
5σ (1 hour): 10pc
5σ (1 hour): 5pc
5σ (1 hour): Alpha Cen


Proxima b
GJ 674 b
YZ Cet b
GJ 436 b
K2-45 b
{2T$_\odot$,2n$_\odot$}
{2T$_\odot$, n$_\odot$}
{ T$_\odot$, n$_\odot$}
radio flux density (μJy)
distance (pc)
(a)

Comparative Planetology







Cost Summary (FY2019$M)		Team X Estimate	
	CBE	Res.	Cost + Reserve
Total Cost	$1080M	27%	$1330M
MMRTG + RHU	$70M	0%	$70M
Launch Vehicle	$150M	0%	$150M
Development & Ops Cost	$865M	29%	
Development Cost	$800M	30%	$1040M
Phase A	$8M	30%	$10M
Phase B	$70M	30%	$90M
Phase C/D	$720M	30%	$940M
Operations Cost (Phase E/F)	$65M	15%	$75M

Dark Ages

Approximately 5000/N hours of integration time is required at 20 MHz to achieve and RMS noise level of $\lesssim$15 mK, assuming a frequency channel width of 1 MHz, which would separate the standard cosmology from added cooling models at $> 5\sigma$.

Additional Science

- First constraints on Dark Ages 21-cm power spectrum (ruling out exotic models)

- Heliophysics

- Monitoring of auroral processes and lightning at Jupiter, Saturn, Uranus and Neptune

- Searches for unknown large magnetized bodies in our solar system (e.g. Planet 9)

- Triggered spectroscopy of exoplanets experiencing geomagnetic storms

- Tomography of the ISM

- Lunar Seismology

- SETI

- Serendipitous!

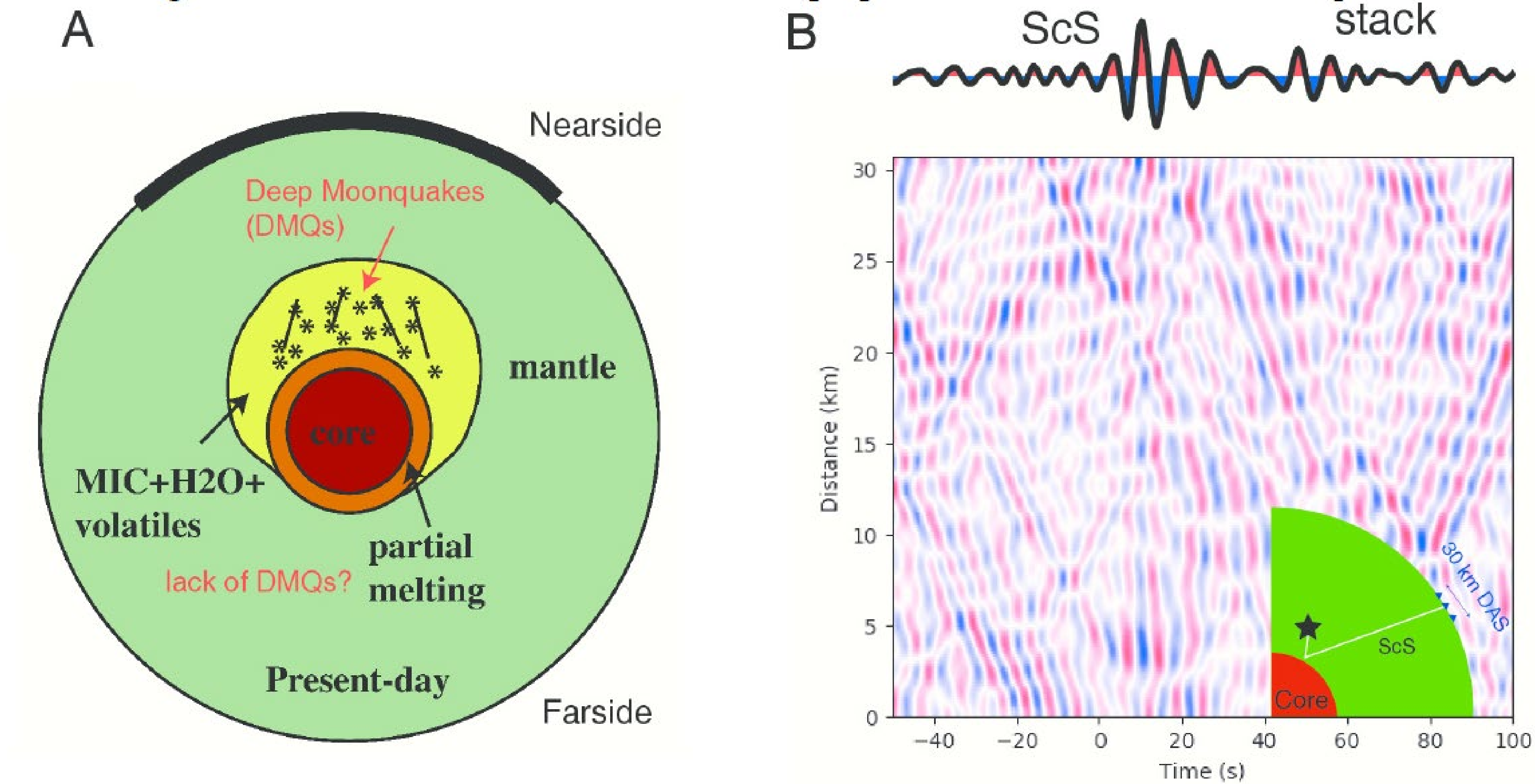


Figure 8. Hypothetic hemispherical lunar structure and a synthetic example of DAS array technique. (A): A schematic representation of the hemispherical lunar structure. Adapted from Qin et al. 2012. (B): A synthetic example of retrieving core phase ScS from a 30-km long DAS array. The strongly scattered seismic waves recorded over the DAS array completely mask the weaker ScS core phase (ray path shown in the inset), but array stacking enhances the signal as shown in the top panel. Time zero is the ScS arrival time predicted by the 1D model (Garcia et al. 2011).