

28 OCTOBER 2018

BRICS ASTRONOMY WORKING GROUP

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# AFRICA TO MOON

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**S**USTAINABLE

**P**IONEERING

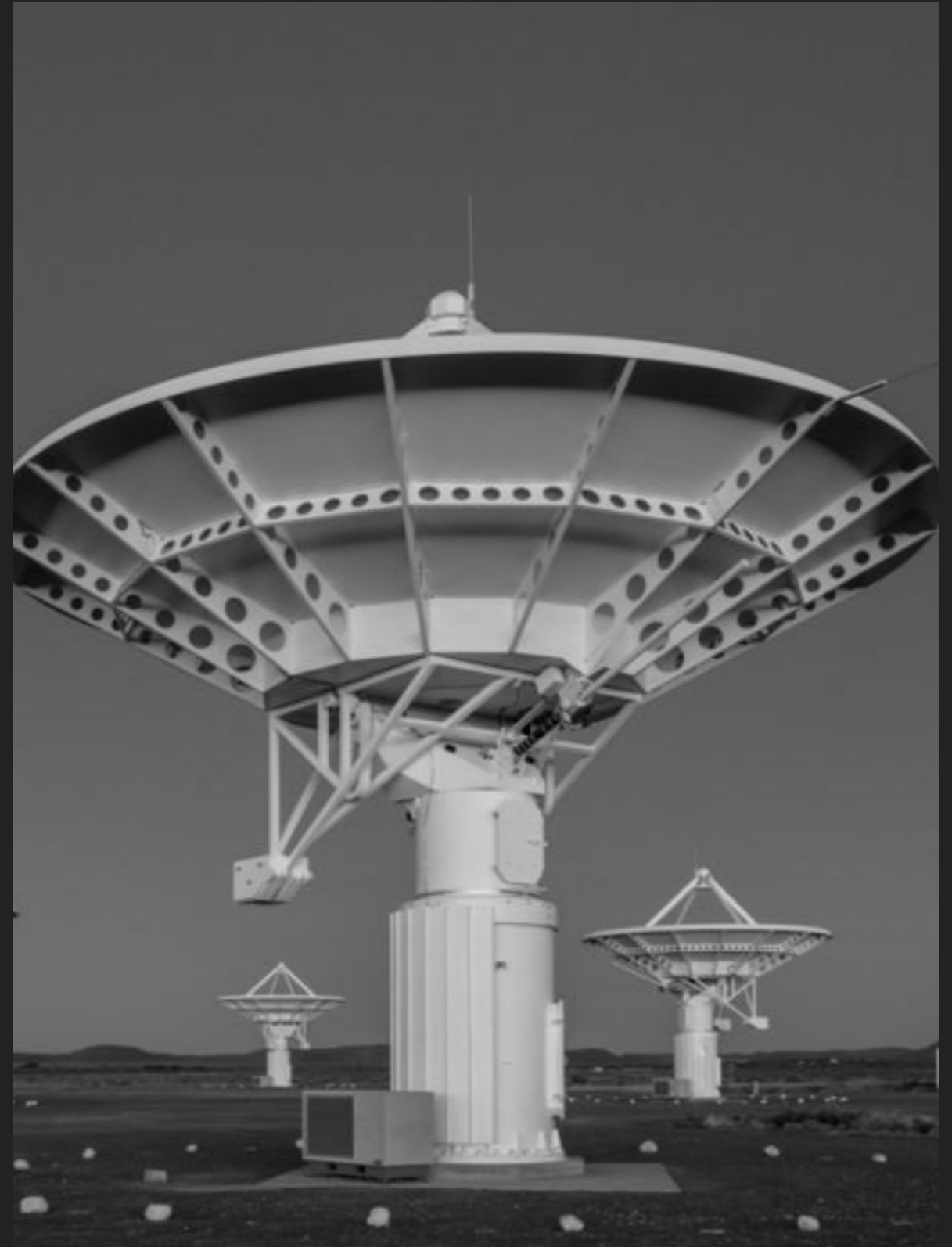
**A**SPIRATIONAL

**C**OLLABORATIVE

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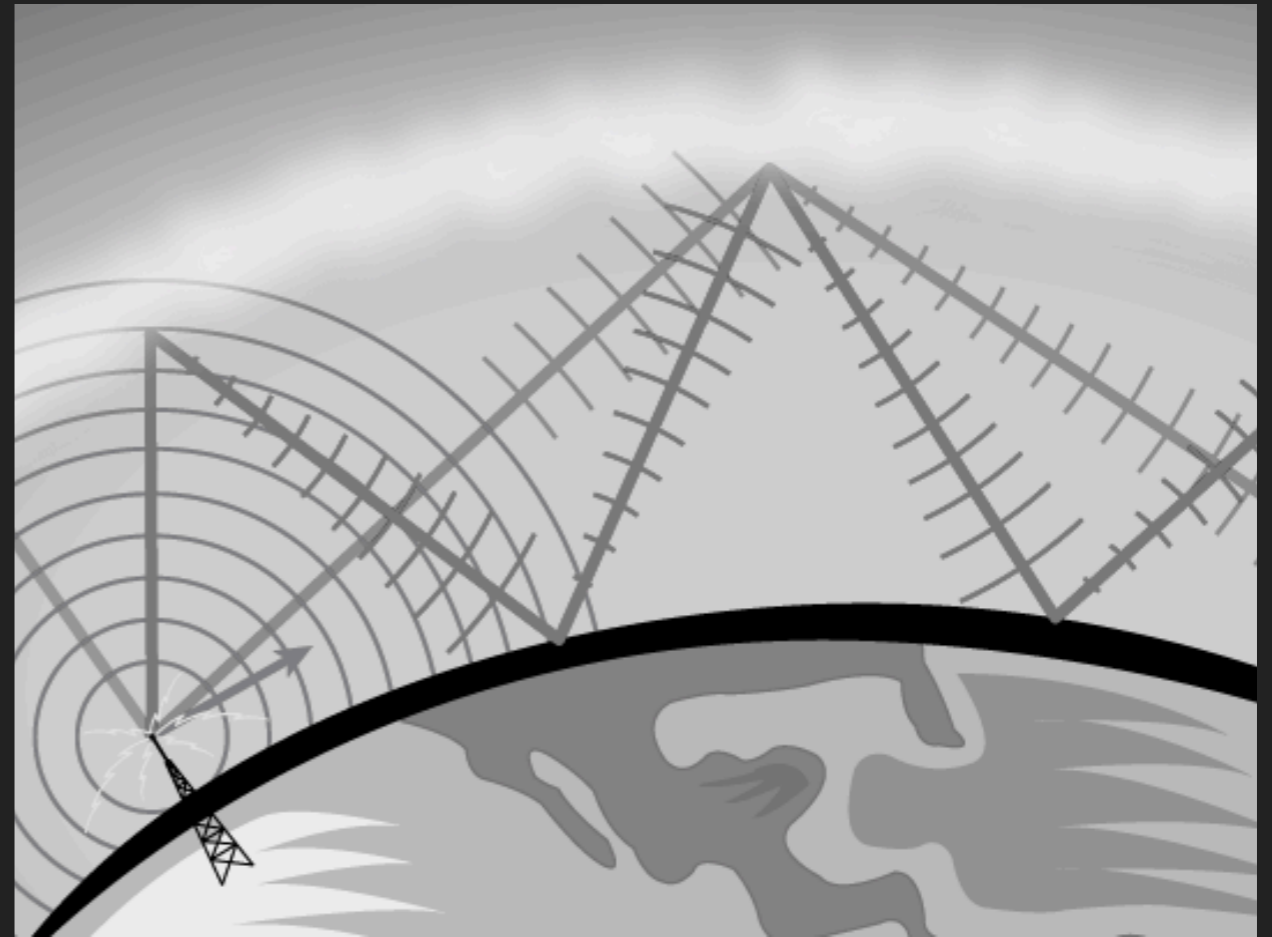
# RADIO ASTRONOMY

- ▶ Radio astronomy instruments detect radio signals from the universe in different frequencies
- ▶ People create radio frequency interference (RFI) through satellites, cell phones to microwaves
- ▶ These instruments are placed in the 'quietist' parts of the Earth
- ▶ The ideal radio quiet zone is the far side of the Moon
- ▶ The far side of the Moon is always pointing away from Earth and is shielded from all our emissions



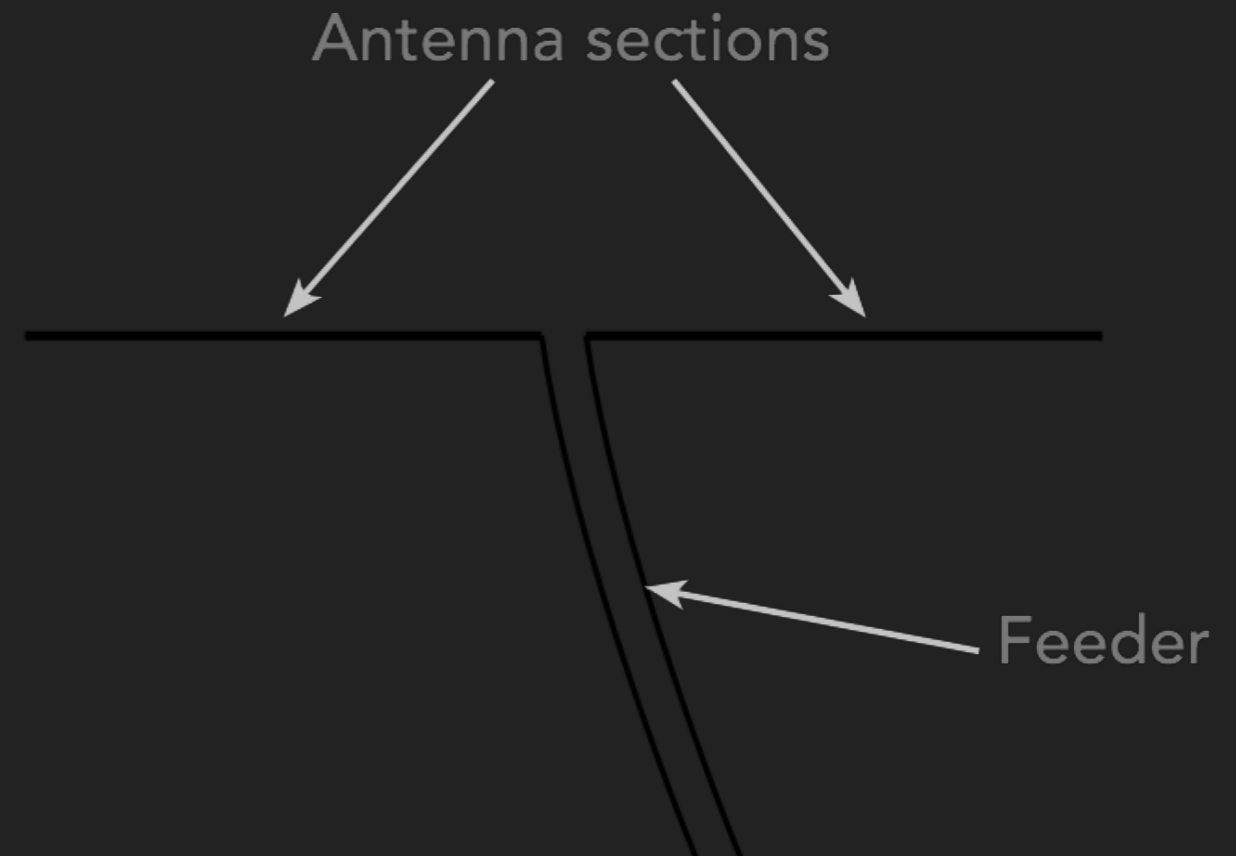
# THE IONOSPHERE

- ▶ The Ionosphere is the layer of the Earth's atmosphere which contains a high concentration of ions and free electrons and is able to reflect radio waves
- ▶ Ground-based radio astronomy is limited to frequencies above about 10 MHz due to the shielding of the Ionosphere
- ▶ Africa To Moon would look to receiving in 1 - 5 MHz as well as mapping the Sun in this frequency range
  - ▶ First time science



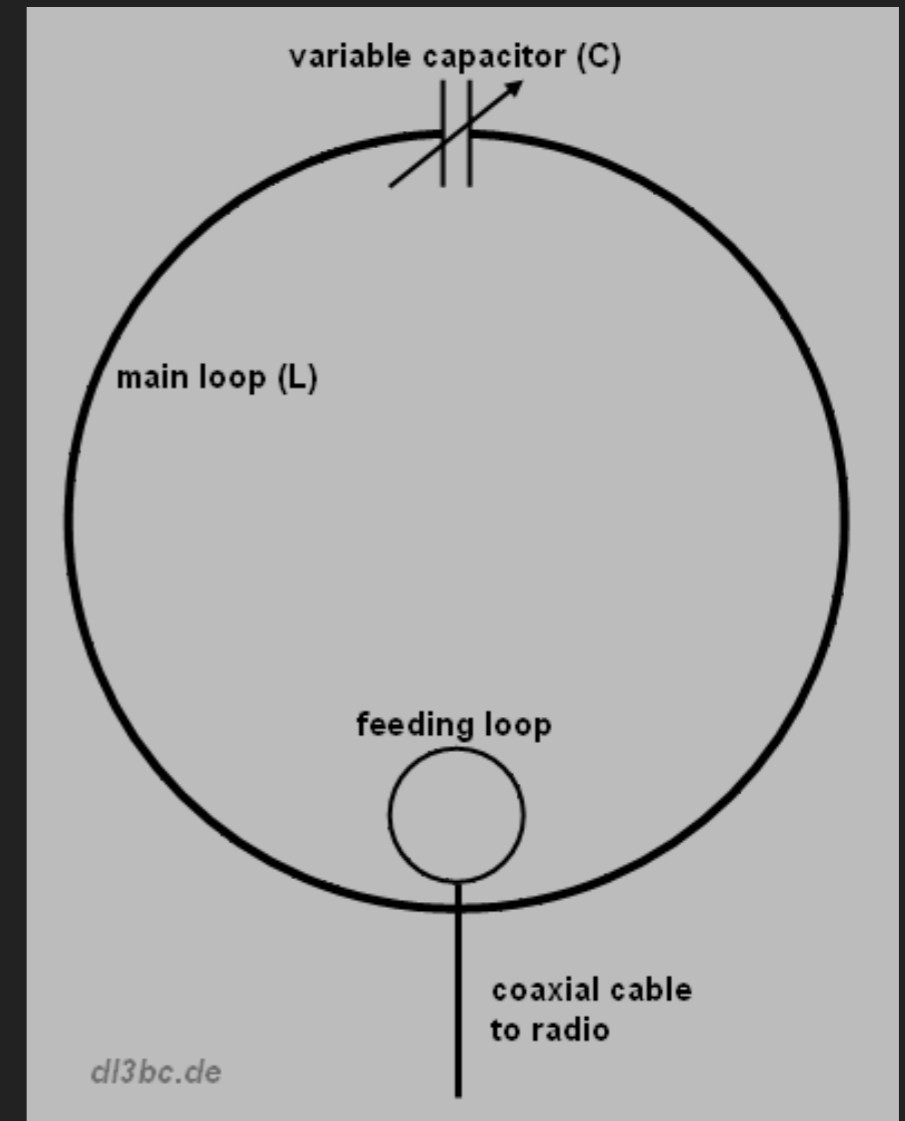
## SIMPLE INSTRUMENTS: DIPOLES

- ▶ A dipole antenna is the simplest type of radio antenna, consisting of a conductive wire rod that is half the length of the maximum wavelength the antenna is to generate
- ▶ Total length of dipole - 1 MHz:
  - ▶ 142.65 meters
- ▶ Length of dipole - 5 MHz:
  - ▶ 28.53 meters



## LOOP ANTENNAS

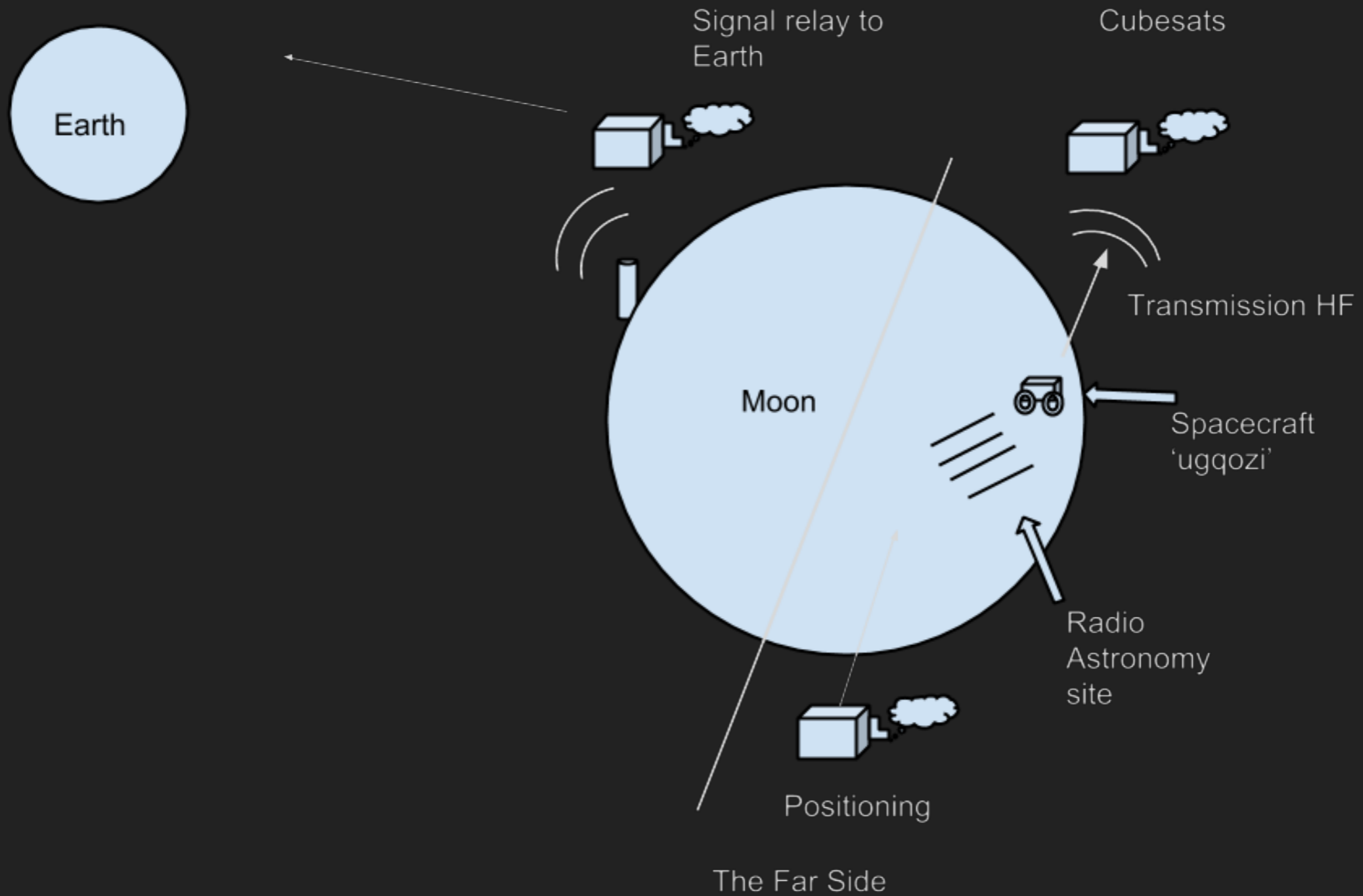
- ▶ A loop antenna consists of a loop, that is a circular electrical conductor
- ▶ A large self-resonant loop antenna has a circumference close to one wavelength of the operating frequency and so is resonant at that frequency
- ▶ Smaller loops of 5% to 30% of a wavelength in circumference use a capacitor to make them resonant



## RADIO ASTRONOMY DARK SIDE (RADS) INSTRUMENTS

- ▶ It is a self inflating plastic ball or 'Moon Ball' (1U flat packed)
- ▶ The loop antenna is deployed in the surface of the ball
- ▶ The capacitor, battery and transmitter are located inside the ball
- ▶ Current study areas:
  - ▶ Materials study for ball structure
  - ▶ Power options for the transmitters
  - ▶ Landing options
  - ▶ Inflation mechanism

# THE MISSION





## THE MISSION OVERVIEW

### WORK PACKAGES AND MILESTONES

- ▶ WP1: RADS Design
- ▶ WP2: Moon Landing system design
- ▶ WP3: Science mission plan
- ▶ WP4: RADS Positioning Satellite design (RPS)
- ▶ WP5: Collaborative instrumentation integration
- ▶ WP6: Spacecraft design
  - ▶ M1: RADS Proof of Concept
  - ▶ M2: RADS Prototype Test
  - ▶ M3: RADS production
  - ▶ M4: Satellite production
  - ▶ M5: Spacecraft production
  - ▶ M6: Launch

### SCHEDULE

WP1: Q2 2024

WP2: Q3 2024

WP3: Q4 2024

WP4: Q4 2024

WP5: Q4 2024

WP6: Q2 2025

M1: Q4 2024

M2: Q2 2025

M3: Q2 2025

M4: Q3 2025

M5: Q4 2025

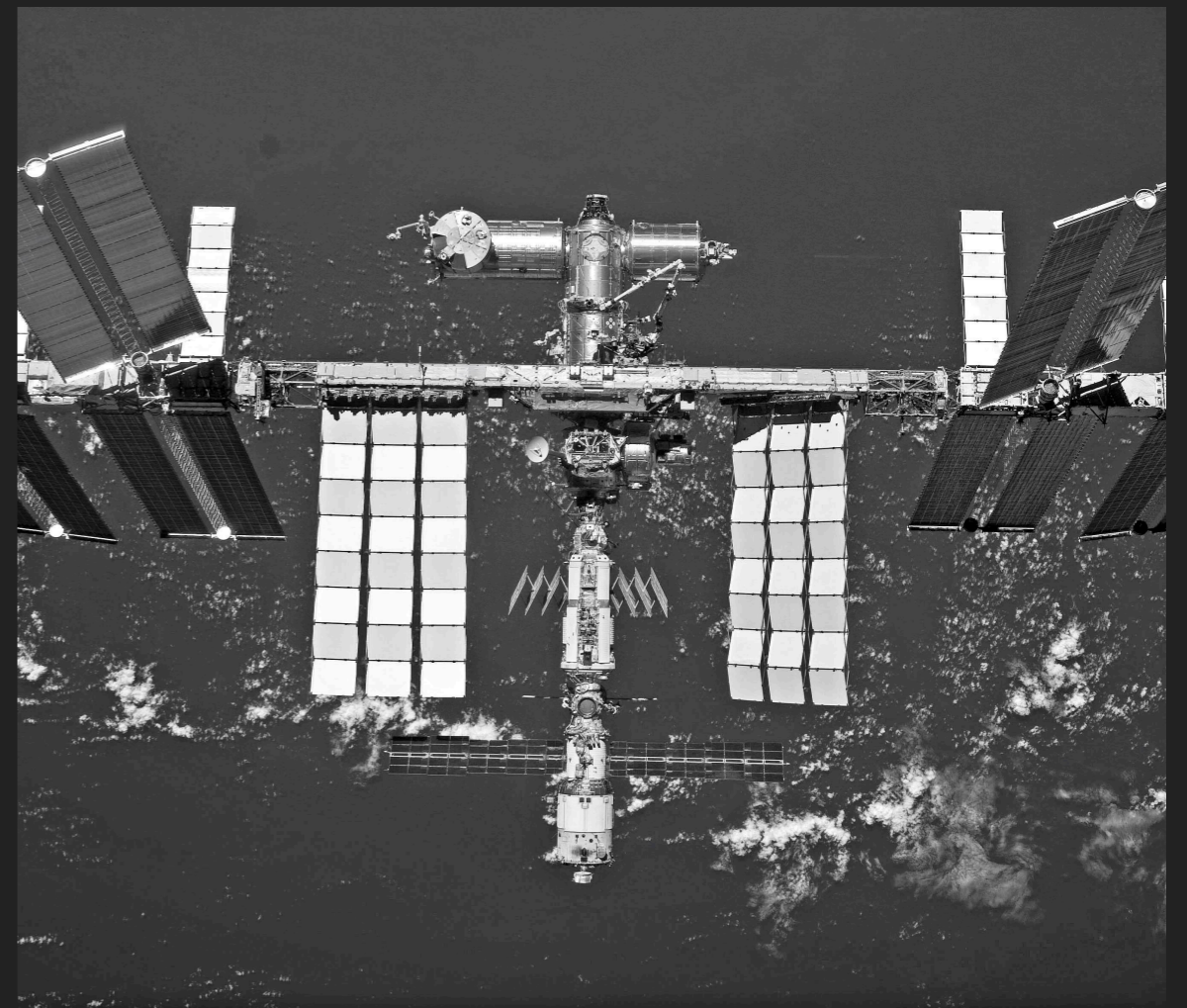
M6: Q1 2026

## THE MAIN MISSION CHALLENGES

- ▶ Positioning of RADS and relay of data
- ▶ Battery life (14 day solar cycle)
- ▶ Lunar Landing and surface deployment

## NEXT STEP: PROOF OF CONCEPT

- ▶ Nanoracks deployment from the International Space Station (ISS)
- ▶ Deployment of 1 RADS from the ISS
- ▶ In space test of inflation and materials as well as instrumentation operations in space environment



## NEXT STEP: PROTOTYPE TEST

- ▶ PT Scientists 'Mission to the Moon'
- ▶ Deployment of 2 RADS by lunar rover in 2020
- ▶ Test the deployment and operation of the RADS



# POTENTIAL COLLABORATORS

PROJECT MANAGEMENT



PROTOTYPE TEST

