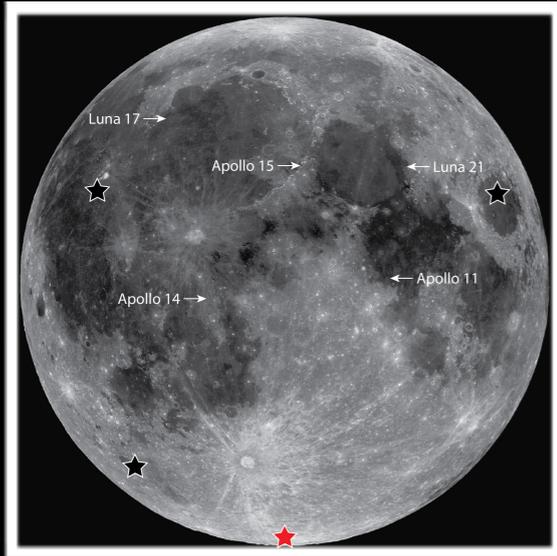
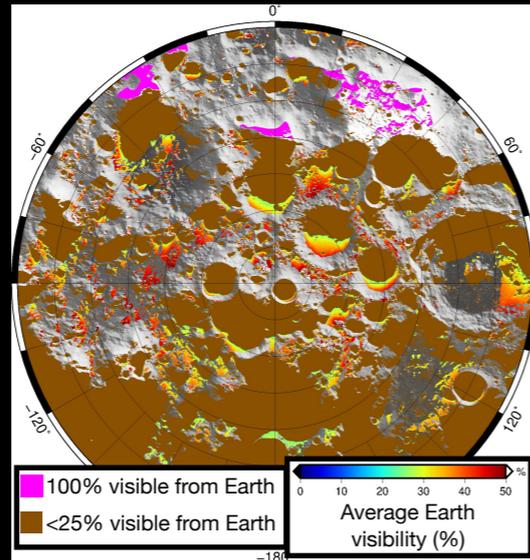


A.

**Lunar South Pole**  
A unique opportunity for LLR



☆ Potential locations for new retro-reflectors from future lander missions

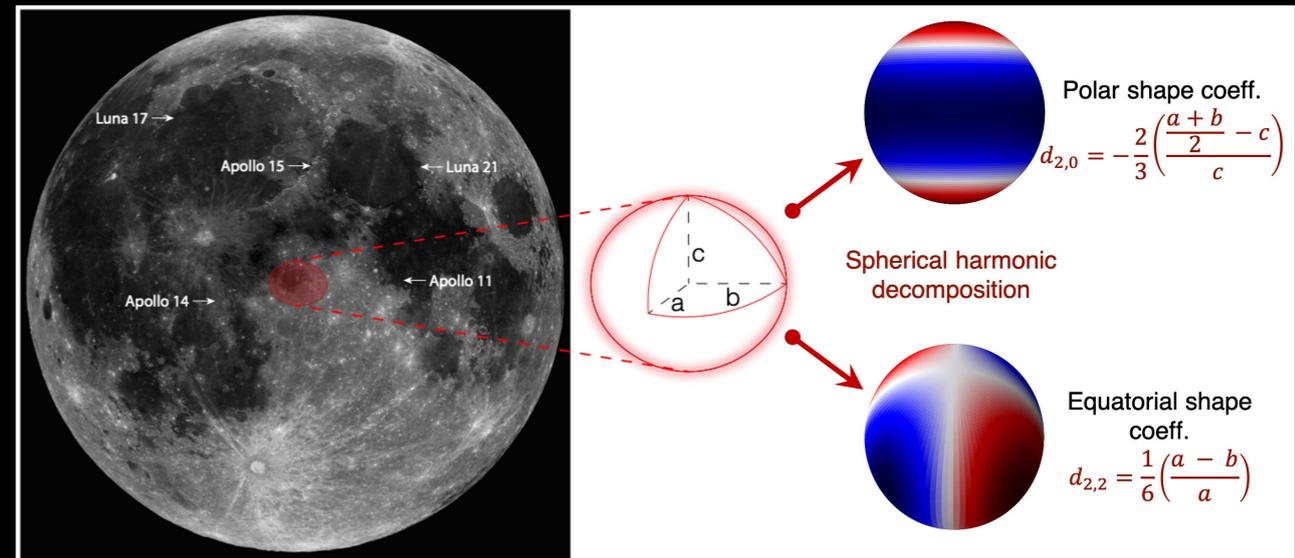


Earth-visible locations at cold regions near lunar south pole

Overcome current thermal-optical design limitation of retro-reflectors

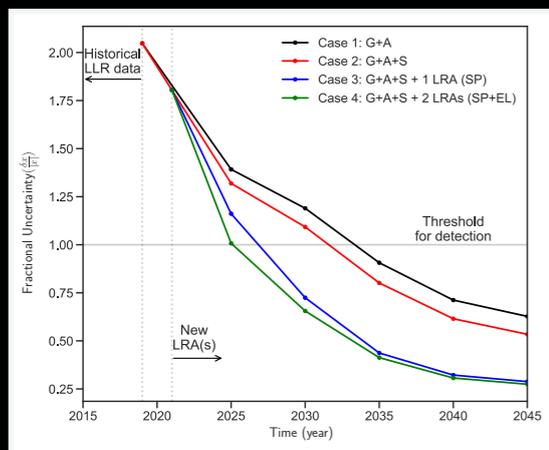
B.

What are the **benefits** of a LLR retro-reflector at the lunar south pole?



Access to higher-order shape of the lunar core-mantle boundary (CMB)  
Ability to drive a past lunar dynamo through elliptical instabilities

C.



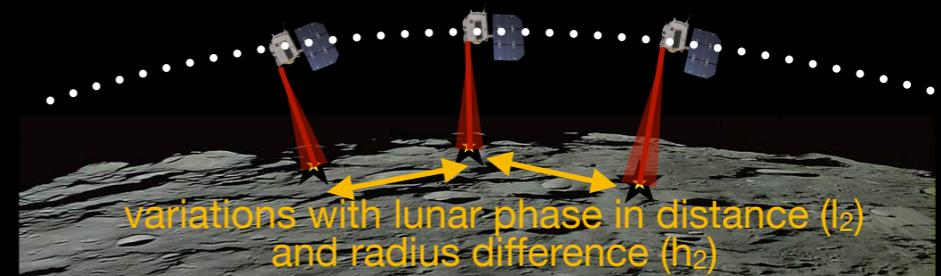
- **Strengthen detection** and reduce precious observation time by almost a decade;
- Presence of equatorial ellipticity of the lunar CMB will modify the **free core nutation** and induce a new proper mode;
- Resolving for the shape will help understand the relaxed (hydrostatic) **state of the lunar core**.

Simulations show multiple benefits for a LLR-retro reflector at the lunar south pole

D.



- Small, light weight, easily mountable on any lander
- Built under **NASA CLPS** and carried by: Beresheet/SpaceIL and Vikram/ISRO
- Planned for flight on: Astrobotic, Intuitive Machines, and Masten



Co-estimation of lunar tidal displacement love numbers ( $h_2$  &  $l_2$ )

**Take away:** Retro-reflectors are **low-cost, deploy & forget** solutions, with demonstrated **longevity** (50+ years) and contribute to **multidisciplinary science**.