A Telescope on the Moon using Moon Dust and Superconductors

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Abstract

The lunar environment is unique. Nights on the Moon are long. The motion of stars across the lunar sky is extremely slow. Temperatures can be very cold, ranging from ~35 K to 100 K. Power availability is limited. Furthermore, telescopes on the Moon - unlike in space - can potentially last forever.

Telescopes and other pointing instruments on the Moon, whether implemented by humans or by robots, therefore require precision pointing systems uniquely suited for the lunar environment.

We report progress in the development of High Temperature Superconductor bearings for lunar telescopes. In addition to telescopes, these bearings can also accommodate other instruments ranging in size from decimeters (laser communication systems), meters (communication dishes, optical interferometers, solar panels), to decameters and beyond (VLA type radio interferometers).

Why Telescopes on the Moon?

Astronomers since the time of Galileo and Herschel have recognized the Moon as the nearly ideal place for an astronomical observatory:
• Large area stable platform
• No atmosphere — no absorption
• low but nonzero gravity
• proximity to Earth
• Long dark times (infinite in polar craters, 14 days elsewhere)
• Permits extremely high resolution optical interferometry*
• Coldest place (35K) in the solar system for infrared astronomy*
• Resources to build extremely large telescopes*

* The last three items are unique to the Moon.

Special Requirements for Moon Telescopes

On the Moon the nights are long (14 days), and temperatures range from 100K to 30K inside shadowed craters. Telescopes on the Moon therefore require bearing systems that can position and track precisely over long time periods, preferably with no maintenance and would not fail with loss of power.

Normal mechanical bearings and lubricants do not function well under these conditions.

We report progress in the development of a new type of bearing mechanism for lunar telescopes based on High Temperature Superconductors.

Acknowledgements

We thank G. Canter, P. Mirel, T. Plummer, D. Linard and M. Perry (NASA GSFC) for advice and assistance.
This work is supported by a grant from the Lunar University Network for Astrophysical Research (LUNAR), Dr. J. Burns, PI.