

ABSTRACT

LSPECS: A Proposed Robotic Astronomy Mission to the Lunar South Polar Regions

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This paper outlines a possible mission to emplace a robotic infrared/submillimeter wave interferometer array near the lunar South Pole. This region has now been investigated by the Clementine and Lunar Prospector missions, and by Earth-based radar, and its topography and thermal environment are fairly well-known. The area would be exceptionally suitable for infrared/submillimeter astronomy because of the continually low temperatures, approaching that of liquid nitrogen (77K) in some places. The presence of ice has been inferred independently from Clementine and Lunar Prospector, providing another incentive for a south polar mission.

A submillimeter spaceborne interferometer mission, Submillimeter Probe of the Evolution of the Cosmic Structure (SPECS) has been proposed by John Mather and others, covering the 40 – 500 micron region with 3 formation flying telescopes. The present paper proposes a lunar adaptation of the SPECS concept, LSPECS. This adaptation would involve landing 4 telescopes on the area north of Shackleton crater at zero degrees longitude. This is in nearly year round darkness but is continually radar visible from Earth. The landed payload of LSPECS would include a telerobotic rover, 4 three meter submm telescopes, a solar power array to be emplaced on the continually sunlit north rim of Shackleton crater, and an S-band antenna for data relay to Earth. Operation without the use of expendable cryogenics for cooling might be possible, trading long exposure time for instrument temperatures above that of liquid helium.

The LSPECS would permit long-term study of an extremely wide range of cosmic and solar system phenomena in the southern celestial hemisphere. For complete sky coverage, a similar installation near the North Pole would be required. The LSPECS site would also be suitable other types of observation, such as optical interferometry or centimeter wavelength radio astronomy. The lunar South Pole is also of great interest because of its extensive ice deposits, which may represent cometary infall with pre-biotic compounds.