The Moon as an Observational Platform for Astronomy .- Long Term Strategy for a Return to the Moon

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The Mission From Planet Earth Study Office in NASA's Office of Space Science develops long range strategy options that return humans to the Moon, Mars and beyond. An important consideration in development of a space exploration strategy is the growing worldwide interest in a return to the Moon. Thus, an element of the strategy that eventual] y takes humans into space could involve the establishment of a permanent human presence on the lunar surface. The scenario that we chose to exami ne would first establish a low cost, remote] y operated observatory on the lunar surface as a first step in the evolutionary establishment of a permanent human presence on the Moon. The initial steps should also be implementable at low cost, but provide a clearly perceived first step to robotic and eventually human presence on the Moon.

In this study five scientific instruments for performing observations from the lunar surface are considered. We believe that low cost implementations that do valuable science can be found.

1 Astrophysical Low-Frequency Array (ALFA)

An interferometer array in space providing sub-degree angular resolution images would allow a wide range of problems in solar, planetary, galactic, and extra galactic astronomy to be attacked.

2 Ultraviolet Astronomy

Rather modest aperture (0.5 to 1.Om) lunar based UV telescopes will be capable of making significant contributions.

3 Infrared Astronomy

Some specific goals of a near infrared wide area survey would be study of low mass stars and, possibly, brown dwarfs, study of newly formed and forming stars, search for and potential measurement of "dark matter" in galaxies and clusters of galaxies, study of the birth and evolution of normal galaxies, understanding the role of ultraluminous and hyperluminous galaxies in the early evolution of galaxies, and measuring the spatial correlation of high redshift galaxies to study large scale structure in the universe.

4 Optical Interferometry

Science opportunities for the Lunar Interferometer are numerous, including mapping of mass outflows and accretion disks of stars, investigating structures of AGNs, and determining cosmic distance scales. Many of these observations are not achievable by other means.

5 Lunar kilometric imaging

An imaging array on the lunar surface would allow remote sensing of kilometric radiation from magnetospheric structures and would image the location of the radiation emanating from the magnetosphere. An image made of this radiation from the lunar surface from a 100-kilometer instrument allows a few-degree resolution of a structure which can extend over the whole sky as seen from the Moon.