

Radio Interferometer Observatory Near the Lunar South Pole

Yuki D. Takahashi

University of California, Berkeley
Physics Department, CA 94720-7300 USA
yukimoon @ socrates.berkeley.edu
Phone 1-510-643-1653; Fax 1-510-643-5204

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The author attempts to contribute toward a proposal to set up a very low frequency (VLF < 30 MHz) radio observatory on the lunar surface. The main motivation for this proposal is two fold: first to make new discoveries about our universe through a completely unexplored window in the electromagnetic spectrum, and also to take on a challenge of lunar development, especially through a multinational effort.

The Moon offers a unique environment that enables astronomical observations that are otherwise impractical. In particular, the Moon can be utilized as a shield and as a large stable platform. For VLF astronomy, these advantages are crucial. Thus far, the Earth's ionosphere and interference have prevented any detailed observations at frequencies below 30 MHz, keeping this VLF window the only remaining part of the electromagnetic spectrum yet to be explored in astronomy. For this reason, the potential for unexpected discoveries is significant. The lunar far side may well be the only site accessible that enables sensitive galactic and extragalactic VLF observations.

Prior to setting up a full-scale observatory on the lunar far side, the most important first step may be to propose a realistic preliminary observatory. It will be for conducting an initial sky survey and testing an array on the lunar surface. Considering the limited budget, the most economical method of deploying a surface array could be as a piggyback payload on an early lander, most likely to the lunar south pole. Such a project could utilize the same transportation, power, and communication systems required for further exploration of the Moon. A simulation study was conducted to explore the possibility of using the 5-km tall Malapert Mountain near the lunar south pole as a shield against terrestrial radio interference. The study seems to indicate a several orders of magnitude attenuation over a region spanning ~50 km on the far side of Malapert Mountain. In hopes to motivate a serious proposal for the first lunar VLF observatory, a preliminary concept for an array to be deployed in this shadowed region is considered. The deployment is probably possible by 2015, if not earlier.

To realize the dream of studying the universe from the Moon, it is time for an international team to begin seriously proposing these missions.