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TITLE: High Angular Resolution Imaging of Solar Radio Bursts from the Lunar Surface

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ABSTRACT BODY: Locating low frequency radio observatories on the lunar surface has a number of advantages, including positional stability and a very low ionospheric radio cutoff. Here, we describe the Radio Observatory on the Lunar Surface for Solar studies (ROLSS), a concept for a low frequency, radio imaging interferometric array designed to study particle acceleration in the corona and inner heliosphere. ROLSS would be deployed during an early lunar sortie or by a robotic rover as part of an unmanned landing. The preferred site is on the lunar near side to simplify the data downlink to Earth. The prime science mission is to image type II and type III solar radio bursts with the aim of determining the sites at and mechanisms by which the radiating particles are accelerated. Secondary science goals include constraining the density of the lunar ionosphere by measuring the low radio frequency cutoff of the solar radio emissions or background galactic radio emission, measuring the flux, particle mass, and arrival direction of interplanetary and interstellar dust, and constraining the low energy electron population in astrophysical sources. Furthermore, ROLSS serves a pathfinder function for larger lunar radio arrays.

Key design requirements on ROLSS include the operational frequency and angular resolution. The electron densities in the solar corona and inner heliosphere are such that the relevant emission occurs below 10 MHz, essentially unobservable from Earth's surface due to the terrestrial ionospheric cutoff. Resolving the potential sites of particle acceleration requires an instrument with an angular resolution of at least 2 deg at 10 MHz, equivalent to a linear array size of approximately one kilometer. The major components of the ROLSS array are 3 antenna arms, each of 500 m length, arranged in a Y formation, with a central electronics package (CEP) at their intersection. Each antenna arm is a linear strip of polyimide film (e.g., Kapton™) on which 16 single polarization dipole antennas are located by depositing a conductor (e.g., silver). The arms also contain transmission lines for carrying the radio signals from the

science antennas to the CEP. Operations would consist of data acquisition during the lunar day, with data downlinks to Earth one or more times every 24 hours.

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