SOLAR IMAGING RADIO ARRAY (SIRA): IMAGING SOLAR, MAGNETOSPHERIC, AND¡BR¿ASTROPHYSICAL SOURCES BELOW 15 MHZ

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The Solar Imaging Radio Array (SIRA) is a space mission to perform aperture synthesis imaging of low frequency solar, magnetospheric, and astrophysical radio sources. The primary science goal is to image radio sources from coronal mass ejection (CME) - driven shock waves in the solar corona and interplanetary plasma. To achieve this, a space-based interferometer is required, because plasma emission frequencies in the solar wind are below the ionospheric cutoff and are, therefore, shielded by the ionosphere. As such, the SIRA mission serves as a lower frequency counterpart to LWA, LOFAR, and similar ground-based radio imaging arrays. SIRA will require 12 to 16 microsatellites to establish a sufficient number of baselines with separations on the order of kilometers. The constellation consists of microsats located quasi-randomly on a spherical shell, initially of radius 5 km or less. Reasonable mission designs can achieve 1 arcmin angular resolution at 15 MHz and 90 dB of dynamic range. We explore the options of both 3-axis stabilized and spinning spacecraft with body-mounted solar arrays and earth pointing high gain antennas. A retrograde orbit at 500,000 km from Earth was selected as the preferred orbit because it reduces the downlink requirement while keeping the microsats sufficiently distant from terrestrial radio interference. Also, the retrograde orbit permits imaging of terrestrial magnetospheric radio sources from varied perspectives. We also consider the possibility of an L1-based constellation. The SIRA mission serves as a pathfinder for space-based satellite constellations and for spacecraft interferometry at shorter wavelengths. SIRA will be proposed to the NASA MIDEX proposal opportunity in mid-2005.

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