URSI GASS 2021, Rome, Italy, 28 August - 4 September 2021

The Sun Radio Interferometer Space Experiment (SunRISE) Mission

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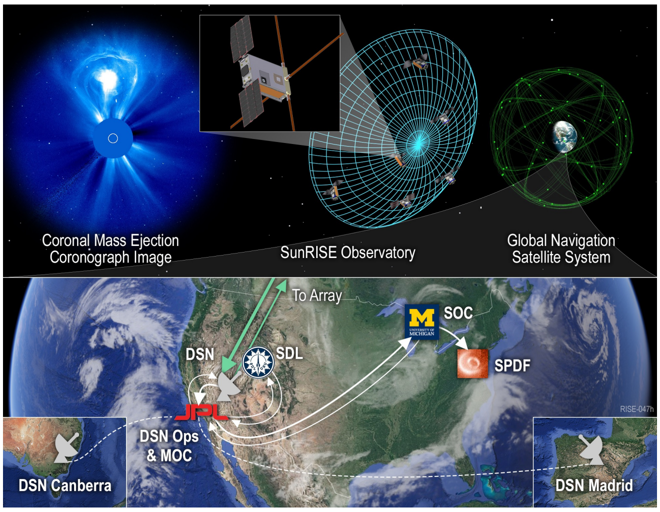
The Sun Radio Interferometer Space Experiment (SunRISE) will provide an entirely new view on particle acceleration and transport in the inner heliosphere by creating the first low radio frequency interferometer in space to localize heliospheric radio emissions. By imaging and determining the location of decametric-hectometric (DH) radio bursts from 0.1 MHz to 25 MHz, SunRISE will provide key information on particle acceleration mechanisms associated with coronal mass ejections (CMEs) and the magnetic field topology from active regions into interplanetary space. Six small spacecraft, of a 6U form factor (10 cm $\times$ 20 cm $\times$ 30 cm volume), will fly, in a passive formation, in a supersynchronous geosynchronous Earth orbit (GEO) within about 10 km of each other, in order to form a very long baseline interferometer (VLBI). SunRISE will image the Sun in a portion of the spectrum that is blocked by the ionosphere and cannot be observed from Earth.



Key aspects that enable this mission are that only position knowledge of the spacecraft is required, not active control, and that the architecture involves a modest amount of on-board processing coupled with significant ground-based processing for navigation, position determination, and science operations. The SunRISE mission leverages more than 50 years of development in VLBI techniques, and mission-enabling advances in software-defined radios, GPS navigation and timing, and small spacecraft technologies, developed and flown over the past few years on DARPA High Frequency Research (DHFR), the Community Initiative for Continuing Earth Radio Occultation (CICERO), and the Mars Cube One (MarCO) missions. The SunRISE mission utilizes commercial access to space, in which the SunRISE spacecraft will be carried to their target orbit as a secondary payload in conjunction with a larger host spacecraft intended for GEO.

Phase B (Formulation) of the SunRISE mission began in 2020 June and is scheduled to complete in 2021 April, to be followed by a decision regarding its suitability to proceed into Phase C (Development). This paper presents a summary of the Phase B (Formulation) work.

Acknowledgements Part of this research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration. This document contains pre-decisional information for planning and discussion purposes only.