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Low Frequency Radio Astronomy from the Moon

A habitable planet orbiting an M dwarf is impacted by an enormous coronal mass ejection. Both the CME produced by the star and the aurora on the exoplanet are associated with luminous bursts of low-frequency radio emission, detectable by FARSIDE

Prof. Jack O. Burns
University of Colorado, Boulder, USA

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Local Host: Dr. Abhirup Datta

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BIO: Jack Burns is a Professor in the Department of Astrophysical and Planetary Sciences at the University of Colorado (CU) Boulder, and is Vice President Emeritus for Academic Affairs and Research for the CU System. Burns is director of the Network for Exploration and Space Science, a $5 million center of excellence funded by the NASA Solar System Exploration Research Virtual Institute. He has 479 publications as listed in NASA's Astrophysics Data System. Burns is an elected Fellow of the American Physical Society and the American Association for the Advancement of Science, and a Legacy Fellow of the American Astronomical Society. He received NASA's Exceptional Public Service Medal in 2010 and NASA's Group Achievement Award for Surface Telerobotics in 2014. Burns was a consultant for ten years at the DOE Los Alamos and Sandia National Laboratories, where he had a security clearance. Burns served on the Presidential Transition Landing Team for NASA in 2016/17, providing leadership on earth and space science. Burns was previously a member of the NASA Advisory Council, serving as Chair of the Science Committee. He served as Senior Vice President of the American Astronomical Society, the world's leading professional astrophysics association, from 2014-17. Burns is currently a member of the Board of Directors of Space Science Institute in Boulder. He has served as Chair of the National Forum for System Chief Academic Officers, as a member of the Executive Committees for the NASULGC Council on Academic Affairs and the Council on Research Policy & Graduate Education, as a founding member of the Board of Directors of the National Center for Women and Information Technology, as Chair of the Board of Directors of the CU University Licensing Equity Holding Inc., as a founding member of the Board of Directors of the Colorado Science Forum, and as Chair of the Southwest Regional Space Task Force.

Abstract: A new era of exploration of the low radio frequency Universe from the Moon will soon be underway with landed payload missions facilitated by NASA's Commercial Lunar Payload Services (CLPS) program. CLPS landers are scheduled to deliver two radio science experiments, ROLSES to the nearside and LuSEE to the farside, beginning in 2021. These instruments would be pathfinders for a 128-element interferometric array, FARSIDE, proposed to be delivered to the lunar surface by a commercial lander later in the decade. ROLSES and LuSEE, operating at frequencies from ≈100 kHz to a few tens of MHz, will investigate the lunar surface plasma environment and measure the fidelity of radio spectra on the surface. Both use electrically-short stacer antennas and radio spectrometers based upon previous flight models. ROLSES will measure the photoelectron sheath to better understand the charging of the lunar surface via photoionization and impacts from the solar wind, charged dust, and current anthropogenic radio frequency interference. LuSEE will measure the local magnetic field and exo-ionospheric density, interplanetary radio bursts, Jovian and terrestrial natural radio emission, and the galactic synchrotron spectrum. FARSIDE, and its precursor risk-reduction six antenna-node array PRIME, would be the first radio interferometers on the Moon. FARSIDE would break new ground by imaging radio emission from Coronal Mass Ejections (CME) beyond 2R⊙, monitor auroral radiation from the B-fields of Uranus and Neptune (not observed since Voyager), and detect radio emission from stellar CMEs and the magnetic fields of nearby potentially habitable exoplanets.

Image credit:NASA