

# Observations of the Sun and Heliosphere Using LOFAR for a Coordinated Ground- and Space-Based Approach to Space-Weather Research.

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Understanding and modelling the complex state of the Sun-solar wind-heliosphere system, requires a comprehensive set of multiwavelength observations. LOFAR has unique capabilities in the radio domain. Some examples of these include: a) the ability to take high-resolution solar dynamic spectra and radio images of the Sun; b) observing the ionospheric scintillation and the interplanetary scintillation (IPS) of distant, compact, astronomical radio sources to determine the density, velocity and turbulence structure of the solar wind; and c) the use of Faraday rotation as a tool to probe the interplanetary magnetic-field strength and direction. However, to better understand and predict how the Sun, its atmosphere, and more in general the Heliosphere works and impacts Earth, the combination of in-situ spacecraft measurements and ground-based remote-sensing observations of coronal and heliospheric plasma parameters is extremely useful. The PSP mission is observing the solar corona and near-Sun interplanetary space. Two instruments on the spacecraft are of particular interest, **FIELDS** measuring the radio emission, electric and magnetic fields, and **WISPR** imaging coronal streamers, coronal mass ejections (CMEs), their associated shocks, and other solar wind structures in the corona and near-Sun interplanetary space. In this talk, the different observing modes of LOFAR and several results of the joint LOFAR/PSP campaign will be presented, including fine structures of radio bursts, localization and kinematics of propagating radio sources in the heliosphere, and the challenges and plans for future observing campaigns including PSP and Solar Orbiter.

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