## EP 8: Sun and Heliosphere II

Time: Thursday 11:00–12:30 Location: KH 01.019

**Invited Talk** EP 8.1 Thu 11:00 KH 01.019

**Solar and heliospheric studies with the LOFAR radio telescope** — •Christian Vocks — Leibniz-Institut für Astrophysik Potsdam (AIP), Potsdam, Germany

LOFAR is a radio interferometer observing in two frequency bands, 10 - 90 MHz and 110 - 250 MHz. As a software telescope, it offers great flexibility and various simultaneous observing modes. Solar radio radiation in the low and high band originates from the upper and middle corona, respectively. Thermal bremsstrahlung of the quiet solar corona provides information on coronal structure and temperatures. Non-thermal plasma emission of energetic electrons from solar flares or coronal mass ejection (CME) shock fronts makes LOFAR well suited for solar activity studies. Observations of type III radio bursts, caused by energetic electron beams, provide information on source locations relative to EUV and X-ray sources, as well as on electron and radio wave propagation in the corona. "beam-formed" images of type II bursts reveal electron acceleration at CME shock fronts.

Since the lowest LOFAR frequencies correspond to the upper corona and transition into the solar wind, LOFAR is an ideal instrument for Space Weather studies. Joint observing campaigns with Solar Orbiter and Parker Solar Probe allow for tracing space weather events from their coronal source through the inner heliosphere on their way towards Earth. LOFAR is currently undergoing the upgrade to LOFAR2.0 with simultaneous low- and high-band observations and improved imaging capabilities. Space Weather studies with LOFAR2.0 will be complementary to the upcoming SKA that covers frequencies above 50 MHz.

EP 8.2 Thu 11:30 KH 01.019

**Transition of energetic electrons from the solar corona into interplanetary space** — •Lilly Zeberer — Universität Potsdam, Institut für Physik und Astronomie, Potsdam, Germany

Solar radio bursts are a phenomenon on the Sun that is closely related to solar flares. They are caused by accelerated energetic particles traveling away from the Sun and are divided into different types. Focusing on type III bursts, their most important feature is the rapid frequency drift from high to low frequencies, corresponding to height in the corona. Using LOFAR data as well as data from the Parker Solar Probe (PSP) FIELDS instrument suite, this work aims to improve a chosen heliospheric density model, especially in the transition region from the solar corona into interplanetary space. Heliospheric density models are an important tool in interpreting radio data, even though the heliosphere is highly structured and they cannot be global. This work uses fitting of the frequency drift of type III radio bursts in combined dynamic spectra of LOFAR and PSP data to then calculate source velocities and observe how they behave as the particles move away from the Sun.

EP 8.3 Thu 11:45 KH 01.019

**Advances in ground-based space weather monitoring with compact CALLISTO** — •Daniela Banyś[1], David Wenzel[1], Lutz Heinrich[1], Frank Tandler[1], and Christian Monstein[2] — [1]Institute for Solar-Terrestrial Physics, German Aerospace Center (DLR e.V.), Germany — [2]Ricerche Solari Locarno IRSOL, Switzerland

DLR has installed various compact CALLISTO receivers as part of the Solar Ionosphere Global Network (SIGN), equipped with spectrometers covering 10-80 MHz, 45-860 MHz, and 1000-1600 MHz in Wairakei, New Zealand. Together with the existing SIGN station in Neustrelitz, Germany, this network provides almost 24/7 continuous observations of solar radio bursts, enabling detailed studies of flare-accelerated electrons and coronal mass ejections. The CALLISTO receivers have been optimized in hardware and software to increase signal-to-noise ratio, simplify maintenance, and improve comparability. Furthermore, a filtering technique has been developed that harmonizes frequency spectra, removes noise, and reduces radio frequency interferences (RFIs), producing cleaner data for automated burst identification and classification.

This setup demonstrates the potential of compact, ground-based CALLISTO stations for continuous solar monitoring and reliable space weather event analysis.

EP 8.4 Thu 12:00 KH 01.019

**Probing Flare Energy Release with STIX Hard X-ray Lightcurves** — •Oliver Flor — Leibniz Institute for Astrophysics Potsdam, Potsdam, Germany — University of Potsdam, Potsdam, Germany

Investigating hard X-ray (HXR) emission provides valuable insights into the energy release and particle acceleration mechanisms inherent to the flaring process. We present a statistical study of the HXR lightcurves of all flares with GOES classification M5 or larger of the current solar cycle that were observed by Solar Orbiter STIX with sufficient counts above 25keV.

Using a suite of timeseries analysis tooles such as Gaussian Decomposition and Wavelet analysis, we investigate how the number of HXR peaks, as well as their periods and amplitudes and the presence of potential quasi periodic pulsations (QPPs) vary across a decade of flare magnitudes.

The results of this data analysis allow us to explore the physical implications of detecting multiple HXR bursts within individual flares. Specifically, we investigate how characteristic timescales and potential QPPs may reflect underlying processes, such as repetitive magnetic reconnection or oscillation of MHD waves, thereby expanding our understanding of energy release during solar flares.

EP 8.5 Thu 12:15 KH 01.019

**Constraining ion acceleration in behind-the-limb gamma-ray flares with Fermi-LAT, SolO/STIX, and ground-based radio observations** — •Alexander Warmuth — Leibniz-Institut für Astrophysik Potsdam (AIP), Potsdam, Germany

Compared to energetic electrons in solar flares, which can be readily observed in hard X-rays and radio, our understanding of energetic ions is severely deficient. Our main diagnostics for ions are gamma-ray observations, which remain challenging. A particularly intriguing case are behind-the-limb (BTL) gamma-ray flares, where the flare is occulted as seen from Earth, but nevertheless gamma-ray emission is detected by near-Earth spacecraft. Here, we investigate the relationship between the gamma-ray emission measured with Fermi-LAT, hard X-ray observations from STIX on Solar Orbiter, and ground-based radio observations, for small sample of BTL gamma-ray flares. In all events, type II radio bursts were present that were synchronized in time with the gamma-ray emission. Conversely, we find a significant delay between the impulsive phase of the flare as recorded by STIX and the gamma-ray emission. These findings support the notion that the highly relativistic ions that produce the gamma-rays in BTL flares are accelerated at CME-driven propagating coronal shock waves rather than in large-scale coronal loops.