Type III Radio Bursts and Langmuir Wave Excitation

Gottfried Mann¹, Christian Vocks¹, Mario Bisi², Eoin Carley³, Bartosz Dabrowski⁴, Richard Fallows⁵, Peter Gallagher⁶, Andrzej Krankowski⁴, Jasmina Magdalenic⁷, Christophe Marque⁷, Diana Morosan⁸, Hanna Rothkaehl⁹, and Pietro Zucca⁵

¹Leibniz-Institut für Astrophysik Potsdam, Potsdam, Germany (gmann@aip.de)
²Science and Technology Facilities Council, Didcot, UK (mario.bisi@stfc.ac.uk)
³Trinity College Dublin, Dublin, Ireland (eoincarley@gmail.com)
⁴University of Warmia and Mazury, Olsztyn, Poland (bartosz.dabrowski@uwm.edu.pl)
⁵ASTRON, Dwingeloo, The Netherlands (fallows@astron.nl)
⁶Dublin Institute for Advanced Studies, Dublin, Ireland (peter.gallagher@dias.ie)
⁷Solar-Terrestrial Center of Excellence, Royal Observatory of Belgium, Brussels, Belgium (jasmina.magdalenic@sidc.be)
⁸University of Helsinki, Helsinki, Finland (diana.morosan@helsinki.fi)
⁹Space Research Center of Polish Academy of Sciences, Warsaw, Poland (hrot@cbk.waw.pl)

Type III radio bursts are a common phenomenon the Sun’s nonthermal radio radiation. They appear as stripes of enhanced radio emission with a rapid drift from high to low frequencies in dynamic radio spectra. They are considered as the radio signatures of beams of energetic electrons travelling along magnetic field lines from the solar corona into the interplanetary space. With the ground based radio interferometer LOFAR and the instrument FIELDS onboard NASA’s “Parker Solar Probe” (PSP), type III radio bursts can be observed simultaneously from high (10-240 MHz) to low frequencies (0.01-20 MHz) with LOFAR and PSP’s FIELDS, respectively. That allows to track these electron beams from the corona up to the interplanetary space. Assuming that a population of energetic electrons is initially injected, the velocity distribution function of these electrons evolves into a beam like one. Such distribution function leads to the excitation of Langmuir waves which convert into radio waves finally observed as type II radio bursts. Numerical calculations of the electron-beam-plasma interaction reveal that the Langmuir waves are excited by different parts of the energetic electrons at different distances in the corona and interplanetary space. This result is compared with special type III radio bursts observed with LOFAR and PSP’s FIELDS.