Neutron Stars and Pulsars: Challenges and Opportunities after 80 years
Proceedings IAU Symposium No. 291, 2012
J. van Leeuwen, ed.

doi:10.1017/S1743921312023733

FRATs: Searching for fast radio transient in real-time with LOFAR

Heino Falcke[1] and the ILT LOFAR Consortium

[1]Radboud University Nijmegen, The Netherlands
email: h.falcke@astro.ru.nl

Abstract. LOFAR is an innovative new radio interferometer operating at low radio frequencies from 10 to 270 MHz. It combines a large field-of-view, high fractional bandwidth, rapid response, and a wide range of baselines from tens of meters to thousand kilometers. Its use of phased-array technology and its digital nature make LOFAR an extremely versatile instrument to search for transient radio phenomena on all time scales. Here we discuss in particular the search for fast radio transients (FRATs) at sub-second time scales. In fact, at these time scales the radio sky is rather dynamic due to coherent emission processes. Objects like pulsars, flaring stars, or planets like Jupiter are able to produce bright short flares. For pulsars, most previous detection strategies made use of the rotation of pulsars to detect them, using Fourier techniques, but it is also possible to detect pulsars and other objects through their single pulses. Such surveys have, e.g., led in the previous decade to the detection of Rapid Radio Transients (RRATS), but the unprobed search space is still rather large. LOFAR is now conducting a rather unique survey over the entire northern sky, searching for bright dispersed single radio pulses. This FRATs survey makes use of the LOFAR transient buffer boards (TBBs), which had initially been used to detect nanosecond radio pulses from cosmic rays. The TBBs store the radio data from each single receiver element of LOFAR and allow one to look back in time. A trigger system that runs parallel to normal imaging observation allows one to detect single pulses in an incoherent beam of all LOFAR stations, covering several tens to hundred square degrees at once. Once triggered, the data can be used to localize the pulse and to discriminate cosmic sources from terrestrial interference through 3D localization. The system has been successfully tested with known pulsars and first results of the ongoing survey will be presented.