A LOFAR high time resolution search for radio bursts from SGR 1935+2154

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A LOFAR high time resolution search for radio bursts from SGR 1935+2154

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Subjects: Radio, Soft Gamma-ray Repeater, Fast Radio Burst, Magnetar

We report on a non-detection of radio bursts from the soft gamma-ray repeater SGR 1935+2154 with LOFAR. These LOFAR observations had the goals of i. studying the detailed morphology of the radio bursts in order to potentially compare with the characteristic time-frequency structure seen in repeating FRBs (Hessels et al. 2019) and ii. studying interstellar scattering along this line of sight. SGR 1935+2154 was observed for 2 hours starting 2020 April 30, 03:30UTC using a tied-array beam from the 24 LOFAR High-Band Antenna (HBA) core stations. Complex voltages were recorded from observing frequencies between 110 to 180 MHz, and coherently dedispersed to the known dispersion measure (DM=332.8 pc/cc) of the burst detected by Scholz et al. (2020, ATEL #13681) and Bochenek et al. (2020, ATEL #13684). Scholz et al. (2020, ATEL #13681) find sub-burst widths of ~5 ms with ~5-10 ms of scattering at 400 MHz. At 150 MHz, we thus expect ~250-500 ms of scattering. Therefore, the resulting dynamic spectra were searched for bursts between DMs of 325 to 375 pc/cc with widths in the range of 0.65 to 900 ms. No bursts were seen down to a fluence of 37 Jy ms for a 20-ms burst at S/N~7 and 199 Jy ms for a 200-ms burst at S/N~12. A simultaneous tied-array beam was pointed towards the millisecond pulsar B1937+21, offset by 1.3 degrees from SGR 1935+2154. The analysis pipeline detected several dozen giant pulses from PSR B1937+21. Analysis of LOFAR imaging observations obtained on 2020 April 29 is ongoing.
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