5G killed the radio star

Hunting radio stars with WSRT

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Radio emission from stellar systems

Radio stars emit radio pulses that are often periodic. They occur on timescales of seconds up to hours, some with periodicity linked to the star's rotation. ECMI and plasma emission are mechanisms responsible for highly circularly polarised emissions. Mildly- to non-polarised components are caused by gyrosynchrotron emission. These bursts are comparable to solar magnetic reconnection events, or Jupiter's auroral radio bursts.

What can we learn from the radio emission?

Stellar radio bursts probe the structure and strength of stellar magnetic fields. They trace plasma density dynamics and allow us to study space weather, such as the conditions of stellar magnetospheres and the impact of stellar plasma on exoplanets.

Furthermore, it is expected that the presence of an exoplanet close to its host star can generate auroral radio emission. This star-planet interaction (SPI) emits ECMI pulses at the local cyclotron frequency, which could serve as a novel detection method and a way to measure the magnetic field of distant systems.

Long monitoring campaigns on radio stars are uncommon but necessary for determining burst rates, energetics, and duration. With WSRT, ASTRON holds an underutilized instrument that could suit these campaigns well.

Observations and Data Reduction

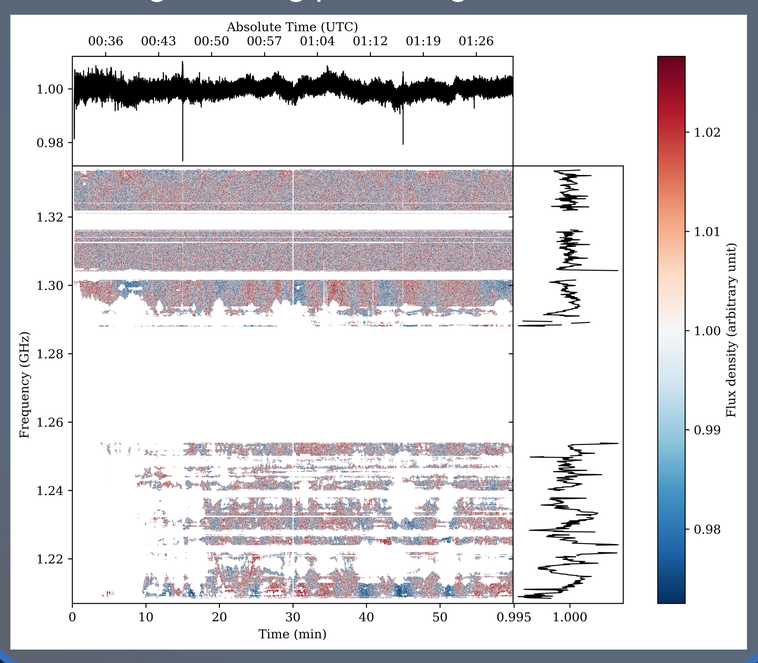
We have conducted observations in the L-band (1.21-1.35GHz) with the 25m dish RT1 of WSRT. The intense and uncharacterised RFI environment necessitates the noise reduction flow we developed: Manually flagging entire sub bands and edges, repeated automatic flagging with AO Flagger, and bandpass and time variation correction using spline fitting per sub band.

We selected the following sources based on previously detected radio bursts and activity, exoplanet presence and source relevance.

PSV-1	68h	(WD binary)
EQ Pegasi	57.5h	(M dwarf binary)
ILT J1101	38.5h	(WD binary)
AD Leonis	36h	(M dwarf)
WX Uma	22.75h	(M dwarf)

Results

We are now producing science-ready dynamic spectra to search for real emission, with a 125kHz frequency- and a 16ms time resolution. Now the 220h of observations can be searched for bursts, with known active stars like AD Leo or EQ Peg showing promising results.



[1] Bloot, S., et al, 2024, Phenomenology and periodicity of radio emission from the stellar system AU Microscopii, A&A, 682, A170
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