Low-frequency radio observations at Lustbühel Observatory

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Lustbühel Radio station

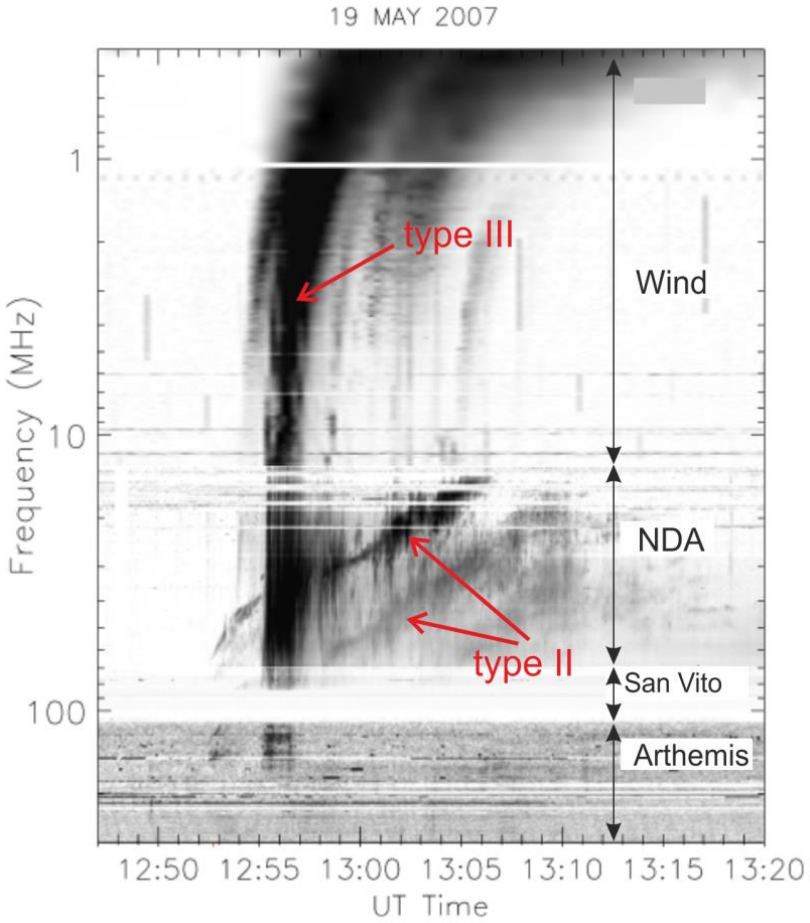
- Lustbühel Radio station consists of two log periodic Yagi antennas with a baseline distance of 80 m in east-west direction.
- The station observed Jupiter using 50 frequency channels receiver enabled simultaneous measurement with a bandwidth of 1 MHz.
- Since 1989 no significant antenna upgrades of the Lustbühel Jupiter radio station has been performed.

FFG ASAP 14 Proposal

The main goal of the proposal is to thoroughly upgrade the existing radio facility at Lustbühel Observatory by constructing a new generation high efficient phased radio array, **L-GURT**, which will be primarily used as a ground radio observation support of ESA Solar Orbiter mission in the decametric frequency range 8 - 80 MHz.

Applicants:

- Space Research Institute, Austrian Academy of Sciences
- Institute of Communication Networks and Satellite Communications, TU Graz
- Commission for Astronomy of the Austrian Academy of Sciences.



Dynamic radio spectra of solar radio burst observed simultaneously by Wind spacecraft (400kHz – 14 MHz) and ground based instruments: Nancay NDA (15-70) MHz, San Vito (70-85 MHz) and ARTEMIS (200-300 MHz). Adopted from *Kerdraon et al,.2010.*

l'Observatoire de Paris | LESIA

Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique

Paris, 20th November 2017

Subject : **Letter of Support for the Austrian SRI commitment in Solar Orbiter/ RPW**

To whom it may concern:

The Radio and Plasma Waves (RPW) experiment was selected as a payload component, with me as the Principal Investigator, of the first ESA Cosmic Vision Mission Solar Orbiter which is planned to be launched in February 2019. RPW will provide in-situ and remote sensing measurements of electrostatic and electromagnetic waves in the solar wind in a broad frequency range from almost DC to 16 MHz.

To reach the top levels mission science goals (see http://sci.esa.int/solar-orbiter/), in addition to the space-based observations, a ground-based support is required for making radio observations at frequencies above 16 MHz.. I Therefore strongly support the initiative of the Austrian Space Research Institute (SRI) group to construct a new low frequency radio telescope at the Lustbuel Observatory. The data from this observatory will be used for the radio ground-based observation support of RPW, providing time continuous radio monitoring of the Sun.

As the principal investigator of Solar Orbiter RPW instrument suite, I would thus highly recommend a positive decision on the funding proposal by SRI and hope that the Austrian Research Promotion Agency (FFG) will allocate adequate funding for this work to support the Solar Orbiter/RPW instrument and allow adequate science return.

Sincerely yours,

Milan Maksimovic

PI of the Solar Orbiter / RPW instrument
Directeur de Recherches with CNRS

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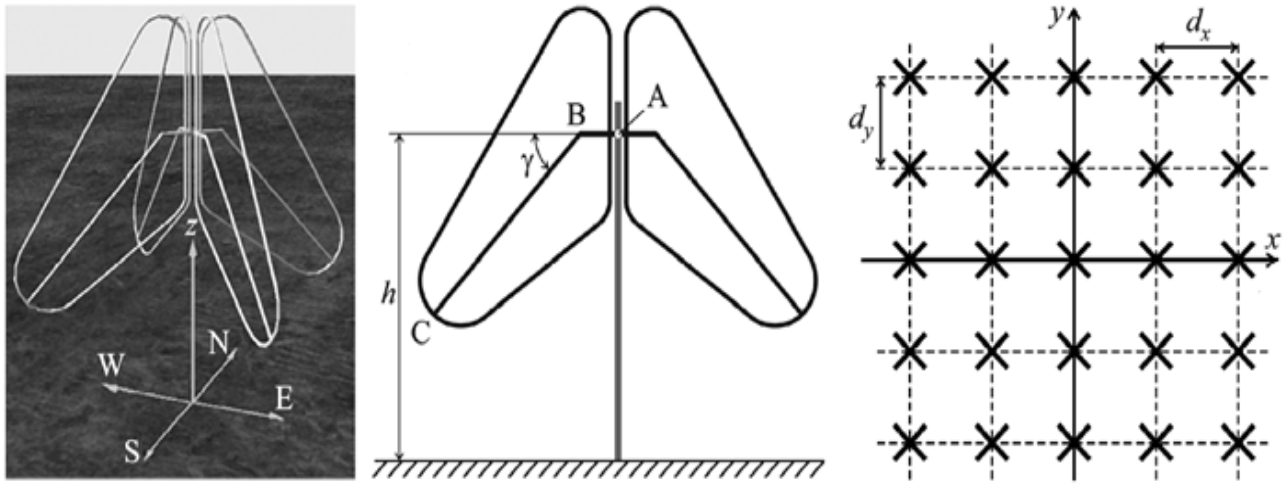
GURT sub array



- Sub-array consists of 25 active dipoles (5×5).
- Each antenna element consists of two crossed dipole antenna providing polarization capability.
- The distance between the dipole antenna elements is 3.75 m, and the height is 1.6 m. Therefore one sub-array can be constructed on an area of 225 m² (15 x 15 m)

GURT sub array

Installation of GURT elements

Antenna type	Phased array
Num. of antennas	25 dipoles
Frequency range	8 - 80 MHz
Effective area	350 m² (40 MHz)
Dynamic range	90 dB
Inst. bandwidth	72 MHz
Number of freq. channels	4 x 14754
Freq. resolution	4.88 kHz
Time resolution	down to 183.5 ns
Polarization	All Stokes parameters

The station can be used as ground based facility to radio observation support of the Solar Orbiter/RPW providing complimentary observations of the solar radio emission with high temporal and frequency resolution.

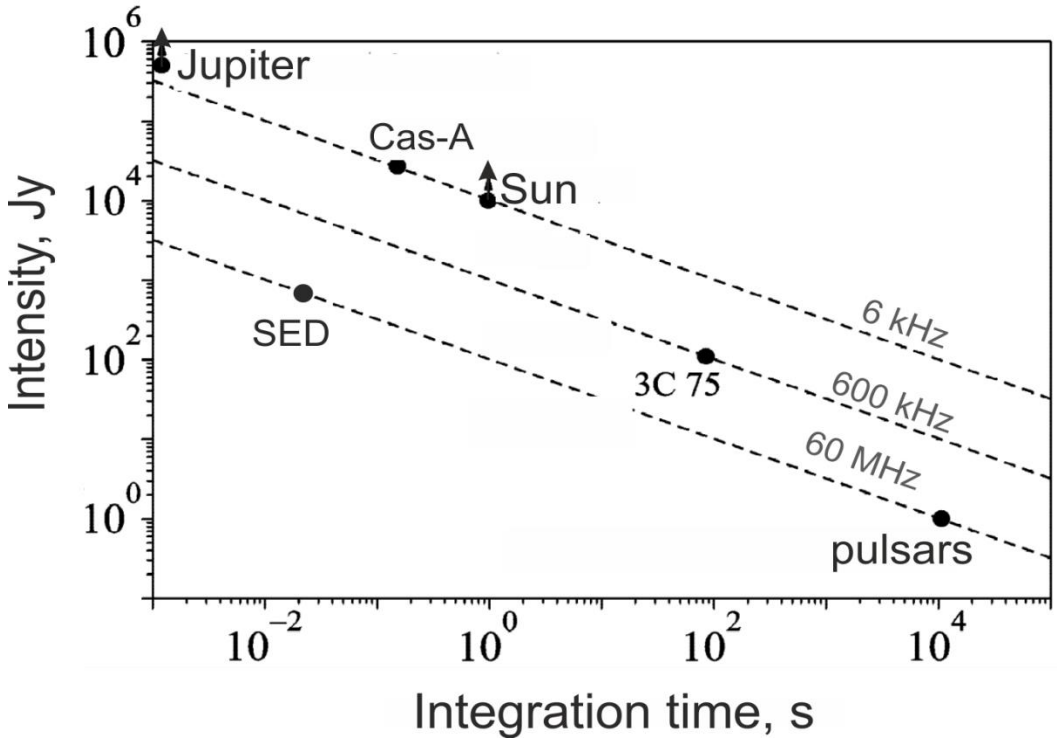
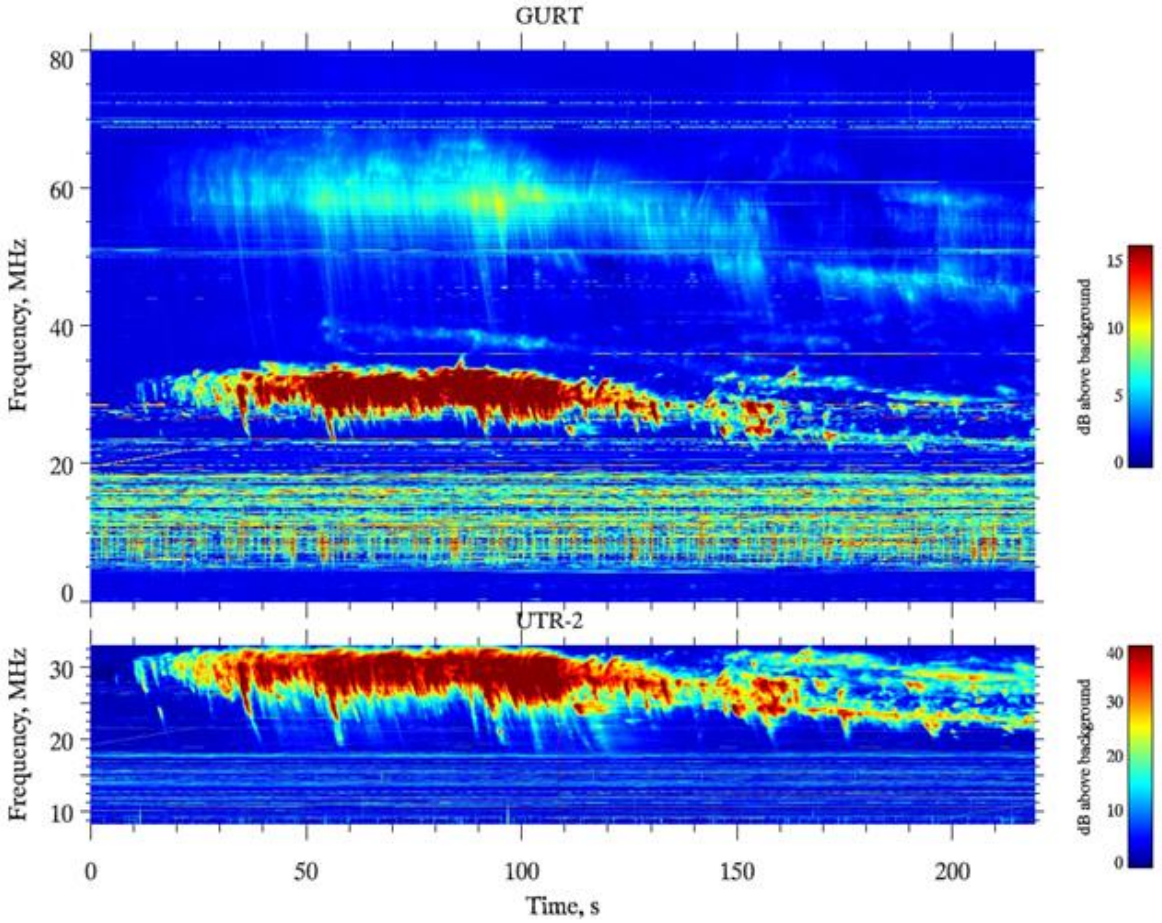


Fig. 3. Sensitivity of one GURT sub-array depending on integration frequency band (dashed lines) and integration time. (SED- Saturn Electrostatic Discharges, 3C75 is a binary black hole system in the Abell 400 cluster of galaxies, Cas-A - Cassiopeia A the brightest extrasolar radio source in the sky.

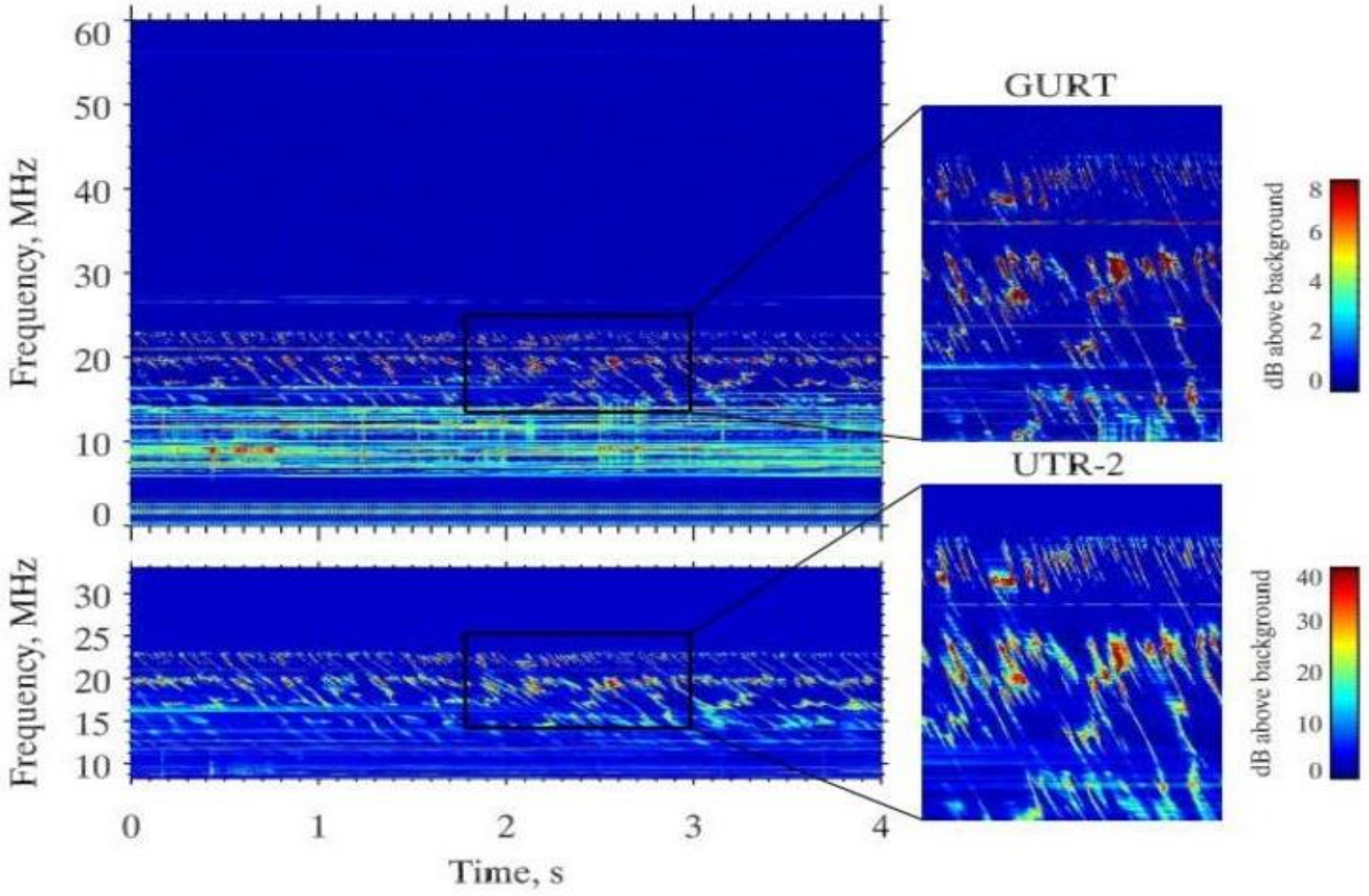
SCIENTIFIC OBJECTIVES

One sub-array of GURT has high sensitivity for brightness temperature which allows to observe:

- Regular observation of the solar radio emission and sporadic solar bursts;
- Jovian radio emission;
- Pulsars at decametric frequencies;
- ionospheric and interplanetary scintillations;
- galactic non-thermal background;
- recombination lines and cosmological effects;



Simultaneous observations of solar type II radio bursts with one GURT sub-array (top panel) and UTR-2 (bottom panel) on July 24, 2014



Jupiter observations (Io-B source) with GURT (upper panels) and UTR-2 (lower panels). The panels show 4 seconds of the recording on 22 February 2015, starting from 20:00:21 UT. The right subpanels are zoomed fragments (1.2 s duration in a 14 – 25 MHz band) of the images located to the left