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Observations of Possibly New OH Excited Rotational State Masers

Search for new New OH Excited Rotational State (ex – OH) masers towards methanol (6.7 GHz) maser sources during the years 2020 – 2021 was done.

- In total 272 sources from Torun methanol maser catalog and 6 GHz Multibeam Maser Surway were selected
- δ > -7.5 deg (to avoid problems with low obs. elevation)
- First phase: 78 objects, search for 6030 and 6035 MHz masers, no 6030 MHz masers found (wide and narrow band) (*See also O. Patoka et al A&A 652, A17 (2021)*)
- Second phase : remaining 194 objects were checked, search only for 6035 MHz masers (narrow band)

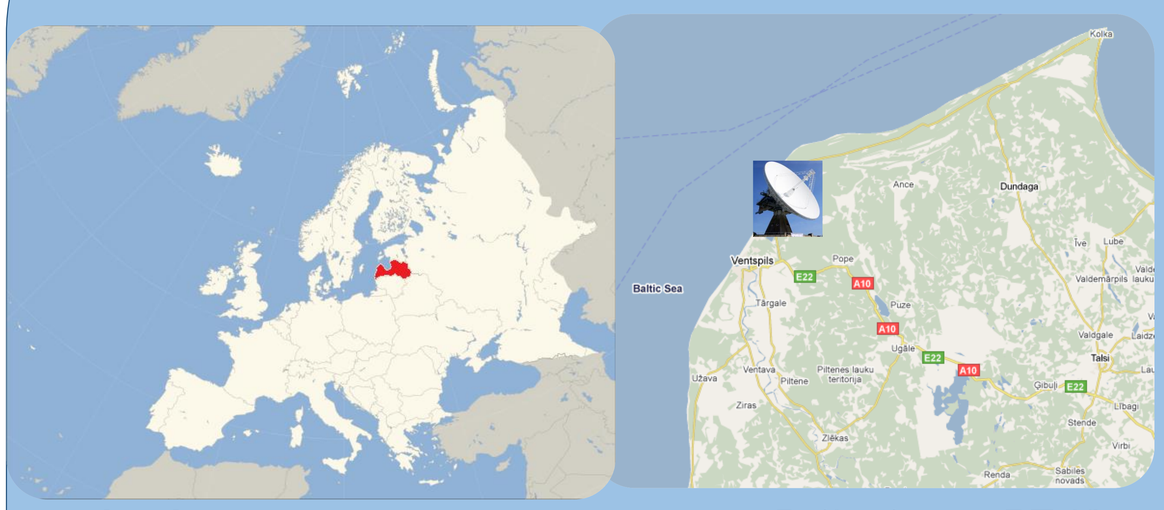
Observation setup wide band

- 12.5 MHz band
- 16384 channels
- 0.762 kHz or 0.04 km/s channel separation
- T_{sys} =28 – 34 K
- Typical observation time ~2h
- Typical 3б noise level 0.35 Jy

Observation setup narrow band:

- 1.5625 MHz band
- 4096 channels (less usable)
- 0.381 kHz or 0.019 km/s channel separation
- T_{sys} = 28 – 34 K
- Typical observation time ~ 4h.
- Typical 3б noise level 0.1 – 0.2 Jy

Ventspils International Radio Astronomy Center (VIRAC) RT-32



Radio telescope **RT-32**
32 meters Cassegrain antenna

Azimuth maximum velocity:
2.8 deg/sec 5 deg/sec
Elevation maximum velocity:
1.8 deg/sec 5 deg/sec
Azimuth range:
-328 - +328 deg
Elevation range:
2.7 – 90 deg
Az/El pointing precision: ~10 arcsec
Surface accuracy (RMS):
0.2 mm 0.1 mm
Working frequency range:
0.3 – 22 GHz 1.4 – 40 GHz

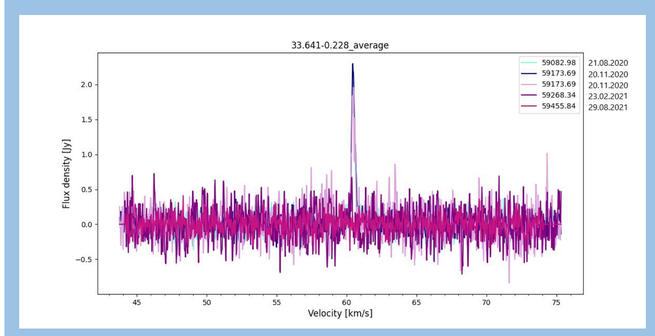
Radio telescope **RT-16**
16 meters Cassegrain antenna

Main receivers: broadband cryogenic 4.5 – 8.8 GHz

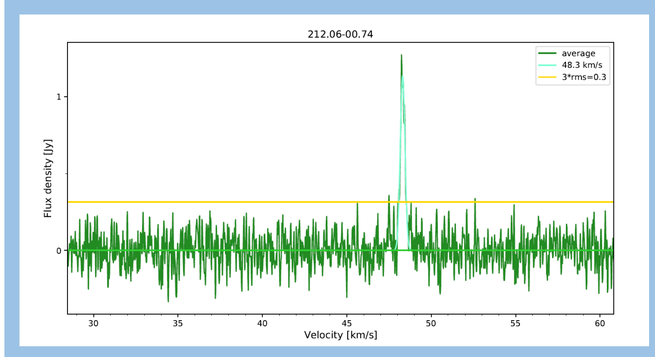
RF Sub-band	RF band (GHz)	IF Output (GHz)	Local Oscillator (GHz)	Image Band (GHz)	Main Working frequencies (GHz)
1	4.5 – 5.5	0.4 – 1.4	4.1	2.7 – 3.7	5.01
2	5.4 – 6.4	0.4 – 1.4	5.0	3.6 – 4.6	6.10
3	6.4 – 7.6	0.3 – 1.5	6.1	4.6 – 5.8	6.70
4	7.6 – 8.8	0.3 – 1.5	7.3	5.8 – 7.0	8.40 & 8.535 - 8580

First Phase: see *O. Patoka et al A&A 652, A17 (2021)*

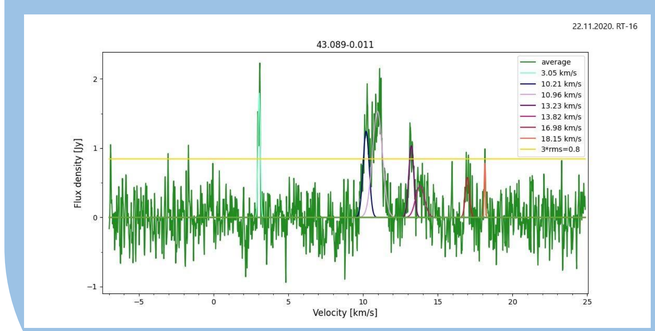
Second phase (first results): 3 potentially new sources detected:



- Detected 21.08.2020. with RT32.
- 20.11.2020 detected with both RT.
- After 95 days days not seen, last observation 29.08.2021., not seen.
- (Flaring?)
- Further observations would be interesting.



- 28.03.2020. Detected with RT-32
- Observations with both Szymczak et al. 2020 telescopes 02.01.2021. below 3 σ.
- Not detected by Szymczak et al. 2020, A&A,642, A145.
- There are not other near sources.
- May be variable
- Further observations needed.



- First observed 11.07.2020 with RT-32
- Observed 22.11.2020 with both telescopes
- Aug. 2021. Reduced to the sensitivity threshold of telescopes
- Seems to be variable, further observations may be interesting

Results both phases in short:

Non detections	212 from 272
Confirmations already known objects	32
Potentially new sources	3
Non clear signal (under 3б), known objects	18
Known sources, seem possibly variable	10
Confirmed Szymczak et al. 2020 sources	2

Conclusions:

- Search for new ex – OH masers towards 272 methanol (6.7 GHz) maser sites in the northern hemisphere was carried out.
- 32 already known objects were confirmed, 3 potentially new and variable sources detected – further observations may be interesting

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