

Recent activities in solar radio astronomy at Metsähovi Radio Observatory

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INTRODUCTION

Beginning from 2001 Metsähovi Radio Observatory has had a radiotelescope (diameter of disk is 1,8 m) for the continuous Sun's total intensity measurements. Radiotelescopes's receiving frequency (center frequency) is 11,2 GHz (beam size 81,6 arcmin) and bandwidth is 1 GHz. Estimated temperature of the quiet Sun level is 12000 K. The main function of radiotelescope has been to detect solar flares/bursts and observe average level of total intensity [1].

Metsähovi has also a large radiotelescope (diameter of disk is 14 m) which can be use for the Sun measurements. With bigger radiotelescope is it possible to make the scans of solar disk or do the tracks from certain objects of solar disk. Used observation frequencies are 36,8 GHz and 86 GHz, respectively beam sizes are 2,5 arcmin and 1,05 arcmin. Estimated temperature of the quiet Sun level at 36,8 GHz is 7800 K and at 86 GHz is 7200 K. Total observation days with large radiotelescope vary between 20-30 days per year during the summer months.

RECENT TECHNICAL UPGRADES AND SCIENTIFIC STUDIES

Recent technical developments have been related to the Metsähovi's small radiotelescope. The main problems have been related to the telescopes pointing, calibration and especially the cause of harmful weather effects. Recent improvements have been related to find solutions for these problems. Other research subject has been to understand the behaviour of the radiotelescope itself; separate the radiotelescope's own noise from desired received signal, and try to find some levels for them [2].

Recent scientific studies have related to find solar oscillations using both Metsähovi radiotelescopes's. We have been studying solar oscillations of the regions quiet Sun level, active regions (like sunspots) and ETRs (*Enhanced Temperature Regions*) in the polar zones of the Sun.

Figure 1 is illustrating the results as an example of the solar oscillations from ETR in the polar zone of the Sun (observed in 23/07/08). Observation has been done with Metsähovi large radiotelescopes's by tracking ETR during 2,5 hours. Data (spectrum) has been obtained with FFT (*Fast Fourier Transform*) analysis. This example shows the oscillations in intervals 3 min, 5 min, 10 min and 15 min. 3 minutes oscillations have been found only one case before us [3].

CONCLUSIONS

We found technical solutions for some problems of the small radiotelescopes. Also we have found some new possibilities and approaches to do solar observations.

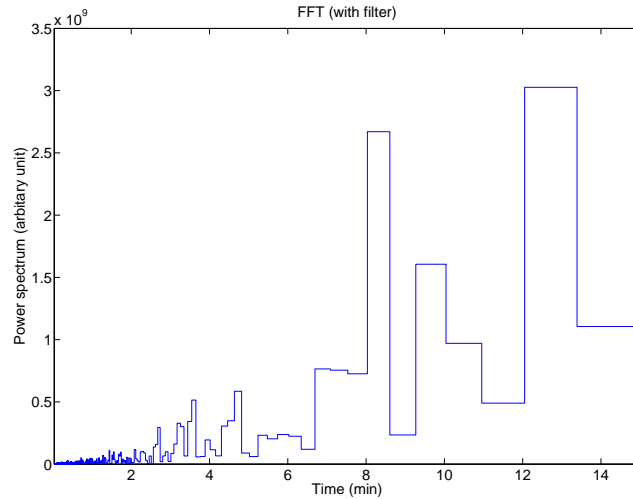


Figure 1: Oscillation intervals (frequencies) in the ETR in the polar zone of the Sun.

We have found solar oscillations at frequencies 5,6 mHz (3 min), 3,3 mHz (5 min), 1,7 mHz (10 min) and 1,1 mHz (15 min). Also longer scale variations (40-60 min) have been found [4].

References

- [1] P. Puhakka, "Total Power Radiometer in Solar Microwave research", *Master's Thesis, Helsinki University, Department of Physical Sciences*, 2002.
- [2] J. Kallunki, "Technical improvements and possibilities to observe solar oscillations with small Metsähovi radiotelescope", *The X Finnish-Russian Radio Astronomy Symposium*, September 2008.
- [3] G. B. Gelfreikh, Y.A. Nagovytsyn, E.Y Nagovytsyna, *PASJ*, 2005, 58, 29.
- [4] J. Kallunki, A. Riehoainen, "Variation of the mm radio emission in the polar zones of the Sun", *12th European Solar Physics Meeting*, September 2008.