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TWENTESAT – THE FIRST LOW-FREQUENCY INTERFEROMETER IN SPACE

Abstract

Low frequency radio astronomy, observing at frequencies below 30 MHz, is one of the last unexplored frequency ranges, and is one of the topics receiving increased interest in astronomy. Since Earth-based observations at those frequencies are not possible, observations have to be done in space. In the OLFAR (Orbiting Low Frequency Array for Radio Astronomy) program we investigate a space-based radio telescope concept. The first step in the program is a demonstrator mission in which we demonstrate the reception of low-frequency data and perform interferometry in space. The (student based) project, Twentesat, aims at a Cubesat mission in which an interferometer of two receivers is created in space. In this paper we will explore this idea in more detail.

The proposed satellite consists of three basic Cubesat building blocks. In space the satellite will split up in two parts, connected with a tether which was stored in the middle part of the satellite. In each of the two parts, a low-frequency receiver and an antenna system is present to measure the astronomical signals. These signals are digitized and correlated in space. The interferometric data will be transmitted to Earth for further processing (eg. imaging). The communication between the two parts will be wireless, so the tether will not be used for signal transport. The final low-frequency radio telescope in space needs to have an aperture diameter of approximately 100 km. Clearly, this is not achieved by the Twentesat mission. The purpose of the mission is to proof the principle of building a huge radio telescope in space. Reception, intersatellite communication and interferometry will be tested in this mission. We also envision a test to correlate the space data with the LOFAR radio telescope. It is therefore necessary to extent the frequency range of Twentesat to also cover the LOFAR frequency range. The frequency range of Twentesat will be from about 1 MHz to 80 MHz.

In conclusion, a new, unique small satellite mission for proof of concept of low frequency radio astronomy is presented. In the paper a more detailed description of the concept is given.