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Decametric observations of Jupiter and the Sun in Nançay : long-term monitoring and ground-based support to Juno and Parker Solar Probe

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Abstract

More than 4 decades after its construction, the Nançay Decameter Array is still in operation in the forest of Sologne (France) and continues to daily acquire value-added low frequency radio observations of the Sun and Jupiter. We will present recent efforts of the NDA team aimed at (i) rehabilitating the collection of analog observations ranging from 1970 to 1990, to valorize the existing digital database and to (ii) ensure efficient support to past/ongoing (and future) space explorations missions such as Juno and Parker Solar Probe with high resolution data and adequate long-term observing strategy.

1. Introduction

The Nançay radio observatory has hosted various radio-telescopes operating at decameter wavelengths, a key spectral domain for solar and magnetospheric physics. Among these, the Nançay Decameter Array (NDA, Fig. 1) is quasi-daily observing Jupiter and the Sun since its completion in 1978 [e.g. 1]. It was preceded by the Nançay Decameter Interferometer (NDI, now decommissioned, Fig. 2) also dedicated to routine observations of the solar system from 1970 to 1978 [2]. Most recently, the NenuFAR giant radiotelescope [3], currently under construction (Fig. 3), started a commissioning phase including punctual observations of Jupiter. Significant efforts of the NDA team have been recently devoted to (i) rehabilitate the collection of archived decametric observations, to valorize the existing digital database and to (ii) ensure efficient support to past/ongoing space explorations missions with high resolution data and adequate long-term observing strategy.

Figure 1: The Nançay Decameter Array is made of 144 helical antennas sensitive to circular polarization.

2. Digitizing the decametric archives

The NDA data obtained since 1990 are acquired in digital format and distributed online through the portal http://www.obs-nancay.fr/. Before this date, the NDA and NDI data were recorded on analog devices such as 35mm films, magnetic tapes and and fac-similes. We recently digitized a collection of ~1500 35-mm films, ranging from 1970 to 1990 [4]. The raw data are about to be delivered publicly. This dataset almost double the length of the existing digital database and will enable one to investigate the variability of jovian and solar radio emissions at unprecendently long timescales (with ~42 years of data encompassing ~2.8 solar cycles and ~3.6 jovian revolutions).

Figure 2: The Nançay Decameter Interferometer included 2 Yagi antenna mounted on mobile booms.

3. Ground-based support

More recently, the NDA has been equipped with sophisticated digital receivers providing high resolution observations [1] in support to Juno, in orbit around Jupiter since mid-2016, and Parker Solar Probe, which went through its first perihelion late 2018. We will present the dataset collected so far, complemented by NenuFAR high sensitivity observations of Jupiter.

Figure 3: The NenuFAR radiotelescope under deployment, with >1000 antennas already installed.

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