Recent Progress of the Mapper of the IGM Spin Temperature (MIST)

Raul A. Monsalve
Department of Physics, McGill University, Montreal, Quebec H3A 2T8, Canada

The Mapper of the IGM Spin Temperature (MIST) is a new experiment trying to detect the global 21-cm signal from the cosmic dawn and the epoch of reionization. The instrument corresponds to a single-antenna total-power radiometer, which possesses key differences with respect to existing instruments. Three versions are currently being developed and built: (1) the main version, which will be part of a permanent installation; (2) a smaller, lower-power version, which has been designed as a portable instrument; and (3) an even smaller, more compact and efficient version. These instruments are intended to observe the sky from remote regions around the world from which currently there are no observations.

In this talk I will describe the three MIST instruments and their development progress. The nominal frequency coverages of the instruments are 0-200 MHz for the permanent version and 0-125 MHz for the portable versions. Among other important differences, one involves their analog front-end sections. The three instruments have switches at the input used for calibration and verification. In the permanent instrument, they are are standard electromechanical switches. In the first portable version they are miniature electromechanical switches; and in the second portable version they are semiconductor switches, which have undergone extensive testing to demonstrate that their performance is sufficient for the 21-cm measurement. The antenna being considered for the three versions of MIST is a broadband horizontal dipole with a zenith-pointing beam. A key difference of this antenna with respect to other experiments is that it is intended to be mounted at a height directly above soil, without a metal ground plane that could complicate the frequency response of the antenna. Although the lack of a metal ground plane increases the ground loss, this effect as well as the beam above the horizon are expected to be frequency-smooth. MIST will benefit from this antenna design and from the calibration functionalities to reduce instrument systematics beyond the state-of-the-art, and achieve the sensitivity to detect the cosmological 21-cm signal.