



Contribution ID: 264

Type: **Oral**

LuSEE Night Electronics Design

Tuesday, 7 November 2023 17:20 (20 minutes)

LuSEE-Night is a project to investigate the feasibility of measuring the fundamental physics processes occurring during the cosmic Dark Ages using instrumentation on the lunar surface. The “Dark Ages” refers to the cosmic era between the last scattering of the cosmic microwave background (CMB) and the time when the first stars and galaxies formed. Only cold, non-luminous hydrogen gas existed during this epoch. The experimental Dark Ages program is based on observations of the hyperfine 21-cm transition of neutral hydrogen, seen against the backlight of the CMB. The global (sky-averaged) spectrum of the redshifted 21cm line is sensitive to the temperature and ionization state of the hydrogen gas and provides a tomographic probe of the thermal history of the early universe. The highly redshifted frequency range between 4 and 40 MHz is particularly of interest. Because of strong terrestrial RFI and ionospheric distortions, this signal cannot be observed from the Earth or from Earth orbit. The detector will therefore be stationed on the lunar surface, on the radio-quiet far side facing away from Earth. To avoid interference from solar RF emissions, cosmology observations will take place during the lunar night.

The LuSEE-Night instrument is a radio frequency spectrometer consisting of a set of antennas, analog and digital signal processing electronics, and the necessary mechanical, thermal, communications, and power delivery hardware to support reliable operation on the lunar surface. Together, the antenna and preamplifier electronics are designed to be sky-noise limited over the 1 - 50 MHz band. Each antenna’s output is processed by a signal chain having analog amplification and filtering, and Nyquist-rate digitization. The four channels of digitized data are fed to an FPGA-based “software-defined radio” signal processor that computes auto- and cross-correlation spectra and stores data in nonvolatile memory. The overview of the LuSEE Night electronics design is reported.

Early Career

Presenter: KOTOV, Ivan (Brookhaven National Laboratory)

Session Classification: RDC5