



# SSERVI Monthly Report

## NESS/PI Burns - December, 2018



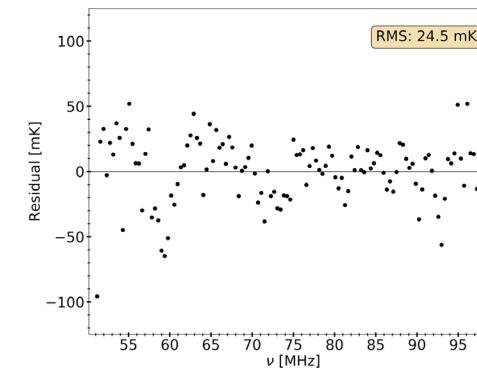
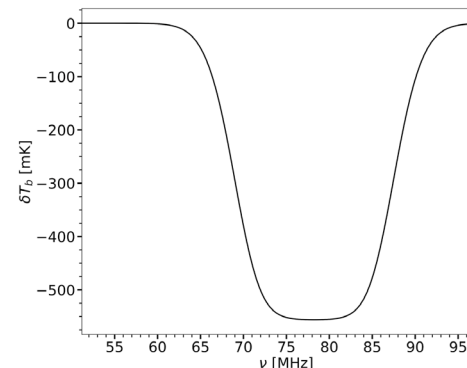
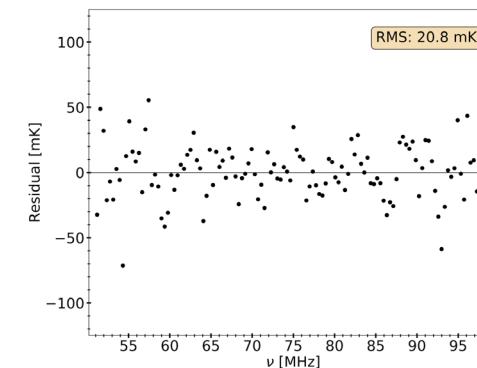
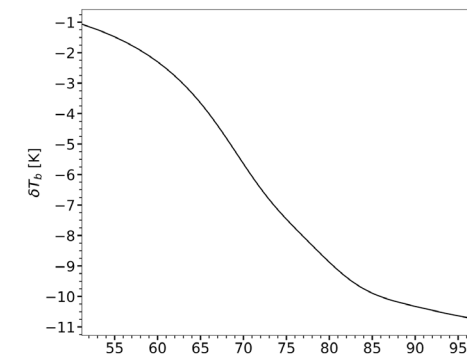
### Progress Report

- **Research highlights:** Mahesh and Bowman have explored the possibility of using planar dipoles on the lunar regolith using simulations in FEKO. Placing the blade dipole on the soil without a ground plane, causes the antenna to look essentially into the lunar surface (i.e., the response towards zenith is  $<1$ ; absolute gain). But on scaling the blade dimensions to an appropriate size (2.5 m x 1.92 m) and placing it 10 cm above the soil gives a reasonable response and bandwidth. The next steps are: 1) looking into Patch antennas as alternatives since this reduces the size considerably and has better gain because of the ground plane; and 2) using model sky temperatures and realized gain of the antenna response, calculating the overall efficiency of the system to sky observations in the desired frequency range.
- **Papers:** (1) Tauscher, Rapetti, Burns, “A new goodness-of-fit statistic and its application to 21-cm cosmology”, published in JCAP, 2018, 12, 015; (2) Mozdzen, Mahesh, Monsalve, Rogers, Bowman, “Spectral Index of the Diffuse Radio Background Between 50 and 100 MHz”, submitted to ApJ, arXiv:1812.02660; (3) Eastwood, Anderson, Monroe, Hallinan, Catha, Dowell, Garsden, Greenhill, Hicks, Kocz, Price, Schinzel, Vedantham, Wang, “The 21 cm Power Spectrum from the Cosmic Dawn: First Results from the OVRO-LWA”, submitted to ApJ.
- **News:** (1) NESS corporate partner [Lockheed Martin selected by NASA as a provider for the Commercial Lunar Payload Services \(CLPS\) program](#); (2) NASA’s Chief Scientist Dr. J. Green visited CU Boulder (11/28/2018) to lecture in Burns’ Space Policy class, interacted with the local NESS team, and presented a seminar at LASP: “[Space weather at Earth and Mars: How Bad Can it Get?](#)”; (3) NASA ARC Director Dr. Eugene Tu visited CU (12/12/2018) to lecture in Burns’ Space Policy class.
- **Papers presented in conferences:** (1) ‘AIAA SPACE’ presentations by Lockheed team in Orlando, on September 17-19: ‘Gateway Mission Operations and Crew Activities’, ‘Crewed Missions to the Martian Surface via Mars Base Camp’; (2) ‘IAC’ in Bremen, Germany, on October 1-5: ‘Concept for a Crewed Lunar Lander Operating from the Lunar Orbiting Platform-Gateway’ by Cichan et al.
- **Talks:** Mirocha gave 1) a KIPAC Cosmology Seminar at Stanford and 2) a SCIPP Seminar at UC Santa Cruz on “New Directions in Galaxy Formation and Cosmology

Following the First High-z 21-cm Detection”.

- **Meeting:** Mirocha participated in the workshop “Near/Far Workshop: The Faint End of the High-z UV Luminosity Function” on December 5-7 in Napa, CA.

### Moment of Science:



Bradley, Tauscher, Rapetti & Burns (2018) reported a possible systematic artifact within ground screens, which moderate Earth effects in 21-cm experiments, that may produce broad absorption features in the observed spectra. The publicly released EDGES dataset, from which a 78 MHz absorption feature was suggested, is used to probe for the presence of ground plane resonances. **Top left:** The sum of three fit resonances at 73.8, 84.2, and 111.8 MHz. Only 2 foreground terms of a polynomial in logarithmic space are employed in this fit. **Top right:** Residuals (RMS: 20.8 mK) to the fit which resulted in the left panel. **Bottom left:** Similar except the foreground is given by a slightly different, 5-term polynomial model and a flattened Gaussian model, used in the fit which produced Fig. 1 of Bowman et al. (2018), is used in place of the resonances. **Bottom right:** The residuals of this fit have an RMS of 24.5 mK.