



# SSERVI Monthly Report

## NESS/PI Burns - January, 2021

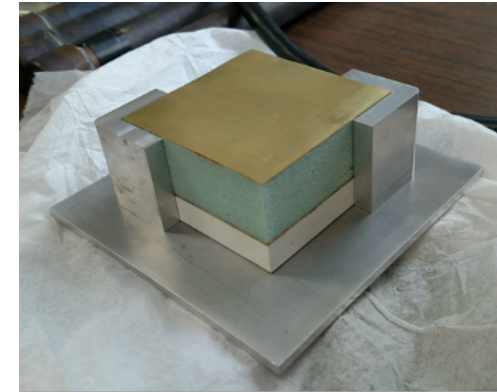


### Progress Report:

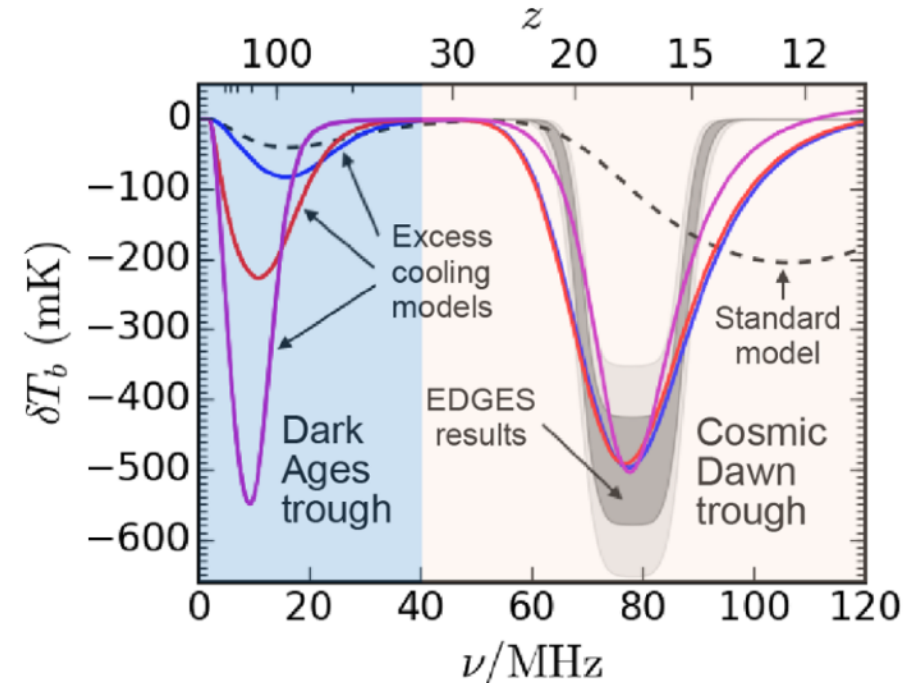
- **Papers:** (1) “Modelling the Galactic Foreground and Beam Chromaticity for Global 21-cm Cosmology”, **Hibbard, Tauscher, Rapetti, Burns**, ApJ, 905, 113; (2) “Ensuring Robustness in Training Set Based Global 21-cm Cosmology Analysis”, **Bassett, Rapetti, Tauscher, Burns, Hibbard**, accepted to ApJ, arXiv:2011.01242; (3) “Quasi-equilibrium models of high-redshift disc galaxy evolution”, **Furlanetto**, MNRAS, 500, 3394; (4) “Transformative Science from the Lunar Farside: Observations of the Dark Ages and Exoplanetary Systems at Low Radio Frequencies”, **Burns**, Phil. Trans. R. Soc. A. 379:20190564; (5) “Low Radio Frequency Observations from the Moon Enabled by NASA Landed Payload Missions”, **Burns, MacDowall, Bale, Hallinan, Bassett, Hegedus**, accepted to PSJ (Planetary Science Journal).
- **News:** (1) [3 questions after the discovery of water molecules on the sunlit moon](#), article on PBS News Hour with quotes from **Burns**; (2) [Scientific Sense podcast features Prof. Jack Burns](#), Scientific Sense podcast conversation with **Burns**; (3) [Astronomers Want to Plant Telescopes on the Moon](#), article from Inside Science with quotes from **Burns**; (4) [Telescopes on Far Side of the Moon Could Illuminate the Cosmic Dark Ages](#), Scientific American article with quotes from **Burns**.
- **NESS Site Visit and Steering Committee:** [Agenda](#) and [video presentations](#) on November 30.
- **Additional Meetings:** (i) *3rd Global 21cm Workshop*, virtual and organized by the University of Cambridge, UK, on Oct. 19-22, with NESS talks on: (1) “Investigations of variations with LST” by **Mahesh**, (2) “DAPPER The Dark Ages Polarimeter PathfinderER” by **Burns**, (3) “Robustly Constraining the Global 21-cm Signal using Pattern Recognition and Bayesian Inference” by **Rapetti**, (4) “A minimum assumption analysis for global 21-cm signal experiments” by **Tauscher**, (5) “Ensuring Robustness in Training set Based Global 21-cm Analysis” by **Bassett**, (6) “EDGES Recombination Line Foregrounds” by **Lewis**; (7) “Eigenanalysis for Foregrounds” by **Hibbard**, (8) “EDGES Calibration Pipeline” by **Murray**, (ii) *237th Meeting of the American Astronomical Society (AAS)*, virtual, on Jan. 10-15, with NESS presentations on: (1) “Status of a Pipeline to Extract the Global 21-cm Signal from a Large Foreground and Constrain Model Parameters” by **Rapetti** (who also chaired another session), (2) “Ensuring Robustness in Training Set Based Global 21-cm Cosmology Analysis” by **Bassett**, (3) “A minimum assumption analysis for global 21-cm signal experiments” by **Tauscher**, (4) “A Roadmap for Radio Astronomy from the Moon” by **Burns** (who also was a panelist in another session).
- **237th AAS splinter session on “Low Frequency Radio Astronomy for Cosmic Origins”:** chaired by **Pober** with NESS talks by **Bowman, Burns, Hegedus, MacDowall, Mahesh, Tauscher, Anderson, and Hallinan**.

### Moment of Science:

**Dark Ages Polarimeter PathfinderER (DAPPER) proposed to PRISM (Payloads and Research Investigations on the Surface of the Moon)**



This 1/15th-scale Patch antenna is a stacked structure with two square pieces of thin brass sheet stock separated by dielectric materials. This structure is attached to a thicker aluminum plate that serves as a rigid base. Coaxial radio frequency connections are attached under the base, with the center conductor extending through the lower dielectric and bonded to the central metal sheet



The global 21-cm spectrum provides a key test of LCDM and possible exotic physics produced by interactions with dark matter, as well as constraints on the properties of primordial stars. The black dashed curve is a prediction using standard cosmology with adiabatic hydrogen gas cooling and star formation similar to that in the Milky Way. The color curves are parametric models with added gas cooling. The grey curves are constraints reported by EDGES.