



SSERVI Monthly Report

NESS/PI Burns - April, 2018



Progress Report

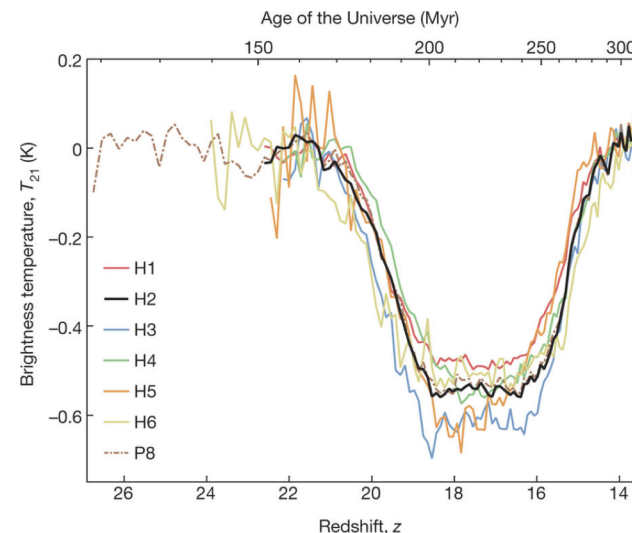
- **Research highlights:** (1) Groundbreaking results (see Moment of Science) from the EDGES collaboration (including NESS members **Bowman, Monsalve & Mahesh**) on discovery of a 78 MHz absorption trough consistent with the long-sought Cosmic Dawn signal ([Bowman et al, Nature 555, 67](#)). The unexpectedly large amplitude of this profile requires non-standard explanations such as interaction between baryons and dark matter particles; (2) **Mirocha & Furlanetto** showed that the timing of the signal provides the first evidence for exotic galaxy formation processes in the very early Universe; (3) At ASU, a new undergrad student working with **Bowman** helped locating candidate sites for a lunar pathfinder array. He began by reviewing LRO radiometer data to see if there are any sites that stay (comparatively) warm during the lunar night around latitude -45 deg. Some locations were found to stay about 10 K warmer than the mean lunar night temperature for their latitude. This project grew out of understanding the siting requirements for an array based on observing constraints and aims at identifying specific sites with the best possible thermal conditions.
- **Papers:** (1) Mirocha & Furlanetto, "What does the first highly-redshifted 21-cm detection tell us about early galaxies?", arXiv:1803.03272; (2) Holland & Burns, "The American Space Exploration Narrative from the Cold War through the Obama Administration", in press at Space Policy, arXiv:1803.11181; (3) Burns, Mellinkoff, Spydell, Fong, Kring, Pratt, Cichan & Edwards, "Science on the lunar surface facilitated by low latency telerobotics from a lunar orbiting platform-gateway", 2018, accepted to Acta Astronautica; (4) Rapetti & Burns, "Low Radio Frequency Astronomy Opportunities from Space", article at the April URSI Commission J Newsletter; (5) Lazio, Hallinan, ..., Farrell, Kasper, et al, "Magnetic Fields of Extrasolar Planets: Planetary Interiors and Habitability", white paper for the National Academy of Science, arXiv:1803.06487.
- **Meeting organization:** **Burns, Bowman, Kasper & Hallinan** are the organizers of an American Astronomical Society Meeting-in-a-Meeting on "Low Radio Frequency Observations from Space" in Denver on June 5-6, 2018.
- **News and media:** Multiple links to news on the EDGES measurements can be found at the NESS website (<https://www.colorado.edu/ness/news>).
- **Mission development:** DAPPER (Dark Ages Polarimeter Pathfinder) kick-off meeting at NASA Ames Research Center on April 19. **Burns** is P.I.

- **Students:** CU grad student Nhan defended his PhD dissertation on the Cosmic Twilight Polarimeter.

Upcoming Events

Meetings: *Triennial Earth-Sun Summit* in Leesburg, VA (May 20-24): (1) **MacDowall** will present on "Complex Type III radio bursts and Their Correlation with Solar Energetic Particle Events"; (2) **Hegedus & Kasper** will present on lunar radio arrays applied to tracking Type II & III bursts out to .5 AU. *URSI AT-RASC* in the Canary Islands, Spain (May 28-June 1): (1) **Rapetti** will talk about "Spaced-based Extraction of the Global 21-cm Spectrum" and about "SVD/MCMC pipeline for separating the global 21-cm signal from foregrounds/systematics"; (2) **Monsalve** will talk about "Extracting the Global Cosmological 21-cm Signal from EDGES Data Using MCMC"; (3) **Bowman** will talk about "The Dawn of 21cm Cosmology with EDGES".

Moment of Science:



This figure shows the redshifted 21-cm absorption spectral feature detected by EDGES. The different lines represent spectra produced using different data sets collected with two instruments in different hardware configurations. The absorption feature is centered at 78 MHz, which corresponds to a redshift $z=17$ for the 21-cm line from the early Universe. The onset of the signal corresponds to an age of 180 Myr after the Big Bang. The amplitude of the signal is >2 times as large as predicted, which may suggest that the hydrogen is cooled via interaction with Dark Matter.

4/25/2018