



SSERVI Monthly Report

NESS/PI Burns - October, 2018



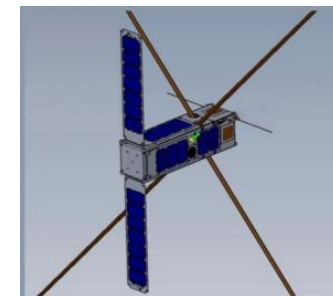
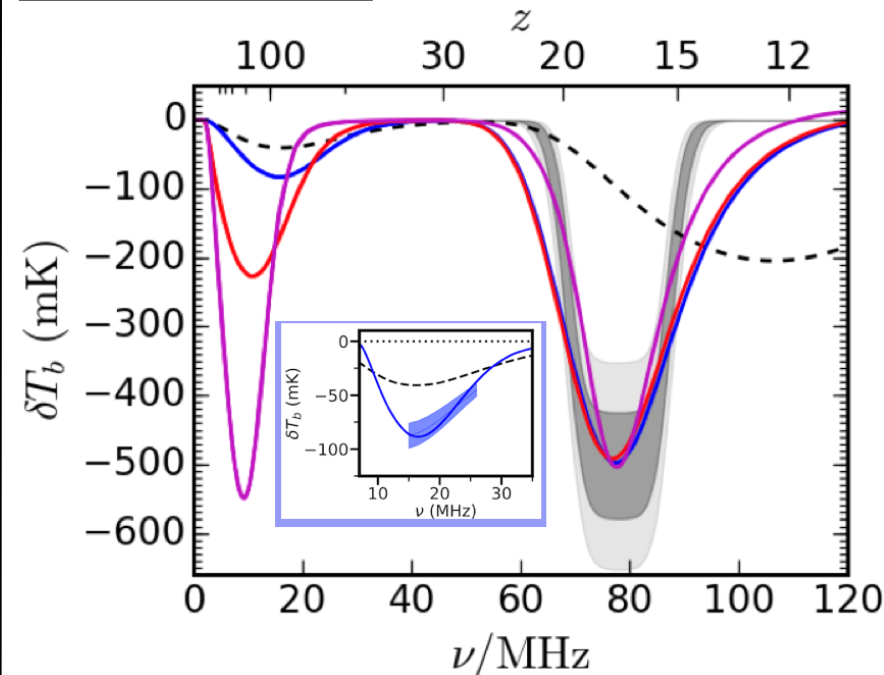
Progress Report

- **Research highlights:** Ground plane resonances could explain the unexpectedly large amplitude of the 21-cm absorption trough found by EDGES (see Bradley et al. below).
- **Papers:** (1) **Tauscher, Rapetti, Burns**, "A new goodness-of-fit statistic and its application to 21-cm cosmology", 2018, arXiv:1810.00076; (2) **Bradley, Tauscher, Rapetti, Burns**, "A Ground Plane Artifact that Induces an Absorption Profile in Averaged Spectra from Global 21-cm Measurements - with Possible Application to EDGES", 2018, arXiv:1810.09015.
- **News/Media:** In connection with the award of a NASA concept study for DAPPER: (1) [‘CU researcher leads lunar observation project: Satellite will help the study of the universe’s “dark ages”](#) by Charlie Brennan, the Denver Post; (2) [‘Dark side of the moon holds clues to early universe’](#) by Daniel Strain, CU Boulder Today; (3) [‘NASA Astrophysics Eyes Big Science with Small Satellites’](#) edited by Sarah Loff, NASA press release. And related with the visit of astronaut-scientist Dr. Schmitt at CU Boulder: [“Apollo astronaut visits campus, shares tales from the Moon”](#).
- **Talks:** **Mirocha** presented on: (1) "New Directions in Galaxy Formation and Cosmology Following the First High-z 21-cm Detection" at the UT Austin astronomy colloquium, September 24, Austin, TX. **Rapetti** presented on: (1) "A novel data analysis pipeline for global 21-cm cosmology with ground and space-based experiments" at a Special USM Seminar, October 17, Munich, Germany; (2) "Dark Hydrogen Cosmology: Searching for Exotic Physics in the Dark Ages" at a CU APS colloquium, October 29, Boulder, CO.
- **Outreach:** (1) **Burns** presented on [“Our Future in Space: Humans, Robots, and Telescopes Exploring Together”](#) at the *International Observe the Moon* night at the Fiske Planetarium, Boulder, CO, October 20, including afterwards (2) Telescope Observations of the Moon at Sommers-Bausch Observatory. (3) Special talk by astronaut, geologist, former senator Dr. Harrison ‘Jack’ Schmitt on "Walking on the Moon: Apollo 17 exploration and beyond", October 29, Fiske Planetarium, Boulder, CO.
- **Meetings:** (1) "Interplay between Particle and Astroparticle physics", Oct 8-12, Cincinnati: **Mirocha** talked about "21-cm cosmology and connections to dark sectors", on Oct 10. (2) ATLAS Community Meeting, Oct 19, Pasadena: **Furlanetto** presented on "Galaxies and Reionization: Cross-Correlating Galaxy Surveys and 21-cm Surveys".

Upcoming Events

- **Meetings:** URSI 2019, January 9-12, Boulder: **Burns** will present on "Dark cosmology: investigations of dark matter in the dark ages with the space-based Dark Ages Polarimeter Pathfinder (DAPPER)"; **Rapetti** on "Full data analysis pipeline for low radio frequency measurements of the dark ages and cosmic dawn"; **Tauscher** on "Confronting the challenges of global EoR detection".

Moment of Science:



DAPPER concept drawing: the Dark Ages Polarimeter Pathfinder (DAPPER) was funded for an Astrophysics SmallSat concept study on September, 2018.

Global 21-cm Spectrum: The dashed black curve is for a standard cosmology model (pre-EDGES). The grey bands show recent EDGES results with $1, 2\sigma$ uncertainties. The colored curves show Cosmic Dawn models with parametric additional cooling and consistent with EDGES, predicting non-degenerate troughs below 30 MHz (Dark Ages). The inset shows DAPPER's expected 1σ measurement error for yet another non-standard model with a moderate amplitude.