



Towards unraveling cosmic dawn: SARAS and PRATUSH experiments

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Detection of redshifted 21-cm signal from the first stars is often regarded as the final frontier of cosmology. However, the detection is plagued by challenges arising from bright synchrotron radiation from the Milky Way, ionospheric disturbances, radio frequency interference, and frequency-dependent interaction of the radio telescope with the sky signal. Key to the detection is the ability to calibrate the telescope response to better than one-part in a million.

SARAS and PRATUSH are single-element radiometers aiming to detect sky-averaged or global 21-cm signal arising from the formation of the first stars and galaxies and the subsequent epoch of reionization. SARAS, operating in the 40-200 MHz frequency range, has undergone a series of editions. SARAS 2 rejected 10% of theoretically predicted models of reionization and constrained astrophysical parameters of the first stars and galaxies. SARAS 3, observing on lakes in 50-100 MHz, has recently refuted the detection of 21-cm signal claimed by the EDGES experiment. It is the first experiment to reach the required sensitivity and cross-examine the claim.

PRATUSH, a proposed space-based radiometer, shares the same science goals. However, it will alleviate multiple problems faced by ground-based experiments like SARAS, including radio frequency interference, ionospheric effects, and antenna interactions with the ground. Phase-I of PRATUSH will seek to fly in a low earth orbit for sensitivity demonstration, early risk mitigation, and preliminary science measurements. It will be followed by the PRATUSH phase-II in lunar orbit in the future.

In this talk, I will discuss the design philosophy of PRATUSH and SARAS, along with their calibration and data processing strategies. I will present the current ground-based concept model of PRATUSH and provide updates on its hardware development and next steps. I will conclude with the latest results from SARAS, including its constraints on astrophysical models of cosmic dawn.

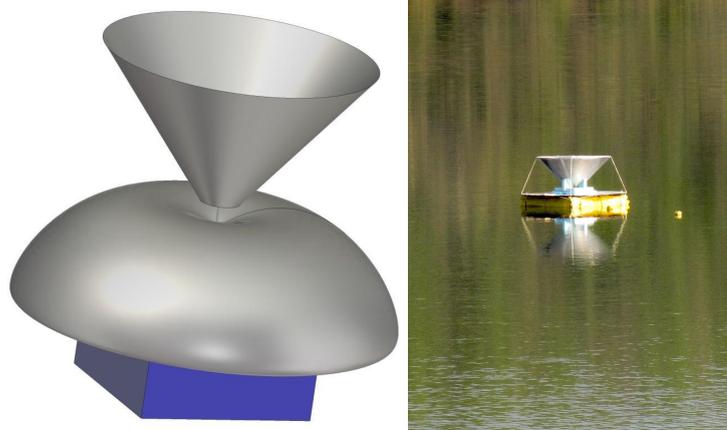


Figure 1. Left panel shows simulated model of PRATUSH payload. Right panel shows SARAS 3 radiometer during observations.