



Studying the Epoch of Reionization and Cosmic Dawn with SKA: An Indian Perspective

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Nearly 200 million years after the Big Bang, it is believed that the first stars, galaxies, and black holes were formed in our universe. The ultraviolet, optical, and X-ray radiation from these first luminous objects initially changed the thermal state and later ionized the neutral hydrogen. This landmark event is known as the Cosmic Dawn and Epoch of Reionization (EoR). Despite its significance, it remains one of the least understood episodes in the history of the universe. The exact timing, properties of the sources, their feedback effects, and the evolution of the large-scale neutral hydrogen (HI) distribution are largely unknown.

Observations of the cosmological HI 21-cm signal from this epoch are perceived as a promising tool to address many of these questions. However, there are several major observational challenges, including accurate calibration of observed data, mitigating strong radio foreground emissions, and dealing with Radio Frequency Interference (RFI) etc. Current telescopes, such as the uGMRT, LOFAR, MWA, HERA, and others, are conducting observations to study this epoch using the HI 21-cm signal. Many important lessons have been learned from these ongoing experiments, which have also placed upper limits on the HI 21-cm power spectrum, leading to significant constraints on models of the EoR HI 21-cm signal.

The upcoming Square Kilometre Array (SKA) is expected to significantly advance this field. The science working group on "EoR & Cosmology" under the SKA India Consortium (SKAIC) has launched several initiatives over the past 8-9 years. These initiatives include numerical modelling of the HI 21-cm signal, observations with the uGMRT to understand various related issues, and developments of methods to interpret the signal. In this presentation, we shall briefly discuss these activities, summarize the important results and findings, discuss challenges being faced and future planning.

1. A. Bera, R. Ghara, A. Chatterjee, K. K. Datta & S. Samui, "Studying Cosmic Dawn using redshifted HI 21-cm signal: A brief review," *Journal of Astrophysics and Astronomy*, Volume 44, Issue 1, 2023, article id.10, doi: <https://10.1007/s12036-022-09904-w>

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2. C. S. Murmu, R. Ghara, S. Majumdar, and K. K. Datta, "Probing the Epoch of Reionization using synergies of line intensity mapping," *Journal of Astrophysics and Astronomy*, Volume 43, 2022, article number 104. Doi: <https://doi.org/10.1007/s12036-022-09882-z>