UNVEILING THE COSMIC DAWN AND EPOCH OF REIONIZATION USING COSMIC 21-CM SIGNAL

Thesis submitted for the partial fulfillment of the requirements for the degree of Doctor of Philosophy in Science

by

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Under the supervision of

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Then even nothingness was not, nor existence. There was no air then, nor the heavens beyond it. Who covered it? Where was it? In whose keeping? Was there then cosmic water, in depths unfathomed? But, after all, who knows, and who can say, Whence it all came, and how creation happened? The gods themselves are later than creation, so who knows truly whence it has arisen?

- Rig Veda, X, 129

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Date: 15/05/2023

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DECLARATION

I hereby declare that this thesis contains original research work carried out by me under the guidance of Dr. Saumyadip Samui, Coordinator and Assistant Professor, School of Astrophysics, Presidency University, Kolkata, India and Dr. Kanan Kumar Datta, Assistant Professor, Jadavpur University, Kolkata, India as part of the Ph.D. programme.

All information in this document have been obtained and presented in accordance with academic rules and ethical conduct.

I also declare that, as required by these rules and conduct, I have fully cited and referenced all materials and results that are not original to this work.

I also declare that, this work has not been submitted for any degree either in part or in full to any other Institute or University before.

Ankita Bera. 15/05/2023

Signature of the candidate with Date

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Certificate

This is to certify that the thesis entitled **"UNVEILING THE COSMIC DAWN AND EPOCH OF REIONIZATION USING COSMIC 21-CM SIGNAL"** submitted by <u>Ankita Bera</u> who got her name registered for Ph.D. programme under our supervision (Registration Number : R-18RS09160150, Date of Registration : 28 August, 2019) and that neither her thesis nor any part of the thesis has been submitted for any degree/diploma or any other academic award anywhere before.

Saumyadip Sami 15/05/2023

Signature of the supervisor with date and official stamp

Kanan Kuman Datta 15/05/2023

Signature of the co-supervisor with date and official stamp

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LIST OF PUBLICATIONS

• Published manuscripts:

- Primordial magnetic fields during the cosmic dawn in light of EDGES 21-cm signal; Ankita Bera, Kanan Kumar Datta, Saumyadip Samui, MNRAS 498, 1, (2020).
- Cosmic recombination history in light of EDGES measurements of the cosmic dawn 21-cm signal; Kanan K. Datta, Aritra Kundu, Ankit Paul, Ankita Bera, Physical Review D, 102, 8, 083502, (2020).
- Studying Cosmic Dawn using redshifted HI 21-cm signal: A brief review;
 Ankita Bera, Raghunath Ghara, Atrideb Chatterjee, Kanan K. Datta, Saumyadip Samui, Journal of Astrophysics and Astronomy, 44, 1, (2023).
- Impact of cosmic rays on the global 21-cm signal during cosmic dawn; Ankita Bera, Saumyadip Samui, and Kanan K. Datta, MNRAS, 519, 4, (2023).

Communicated manuscripts:

- Bridging the gap between Cosmic Dawn and Reionization favors Faint Galaxiesdominated Models; Ankita Bera, Sultan Hassan, Aaron Smith, Renyue Cen, Enrico Garaldi, Rahul Kannan, and Mark Vogelsberger, Under review in ApJ, (2022), [https://ui.adsabs.harvard.edu/abs/2022arXiv220914312B].
- JWST constraints on the UV luminosity density at cosmic dawn: implications for 21-cm cosmology; Sultan Hassan, Christopher C. Lovell, Piero Madau, Marc Huertas-Company, Rachel S. Somerville, Blakesley Burkhart, Keri L. Dixon, Robert Feldmann, Tjitske K. Starkenburg, John F. Wu, Christian Kragh Jespersen, Joseph D. Gelfand, Ankita Bera, Submitted to ApJL, (2023), [https://ui.adsabs.harvard.edu/abs/2023arXiv230502703H/abstract].

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