



## **Towards accurate modelling of the HI 21-cm signal from cosmic dawn and epoch of reionization**

**Kanan K. Datta, Rajesh Mondal, Raghunath Ghara, Suman Majumdar, Somnath Bharadwaj, T. Roy Choudhury**, e-mail: datta.kanan@gmail.com

Observation of the HI 21-cm signal is one of the most promising tools for probing the epoch of deionization (EoR) and cosmic dawn (CD). Therefore, it is important to understand the expected HI 21-cm signal and its dependence on various unknown parameters such as the nature and clustering of reionizing sources, feedback mechanisms, clumping of HI, line of sight effects (peculiar velocity, light cone effect etc). Simulation is, perhaps, the best way to investigate, in detail, all these effects and accurately predict for the HI 21-cm signal from the EoR and CD. Simulated HI 21-cm signal is also an essential ingredient for studying various foreground subtraction techniques, instrumental effects, information extraction algorithms etc. Various techniques such as the semi-numerical, 1D and 3D radiative transfer, hydrodynamical simulations have been developed over the past decade.

We shall present some of these simulation techniques, their advantages/disadvantages in the context of HI 21-cm signal from the EoR and CD. Further, we shall discuss a few applications of these simulations such as the effects of peculiar velocities, light cone effect, ionized regions around bright QSOs, effect of X-ray and Ly-alpha photons during the CD and show recent results. Finally, We shall focus on some major challenges faced by the community in order to accurately and efficiently model HI 21-cm signal that mimics current and future observations.

### References:

1. Prediction of the 21-cm signal from reionization: comparison between 3D and 1D radiative transfer schemes  
Raghunath Ghara, Garrelt Mellema, Sambit K. Giri, T. Roy Choudhury, Kanan K. Datta, Suman Majumdar, 2018, MNRAS, Volume 476, Issue 2, p.1741-1755, arXiv:1710.09397
2. Towards simulating and quantifying the light-cone EoR 21-cm signal  
Rajesh Mondal, Somnath Bharadwaj, Kanan K. Datta, 2018, MNRAS, 474, 1390, arxiv:1706.09449
3. Probing individual sources during reionization and cosmic dawn using SKA HI 21-cm observations  
Kanan K. Datta, Raghunath Ghara, Suman Majumdar, T. Roy Choudhury, Somnath Bharadwaj, Himadri Roy, Abhirup Datta, accepted in Journal of Astrophysics and Astronomy (SKA-India special issue), 2016
4. Modelling the 21 cm Signal From the Epoch of Reionization and Cosmic Dawn  
T. Roy Choudhury, Kanan K. Datta, Suman Majumdar, Raghunath Ghara, Aseem Paranjape, Rajesh Mondal, Somnath Bharadwaj, Soumyadeep Samui, accepted in Journal of Astrophysics and Astronomy (SKA-India special issue), 2016

## 5. Line of sight anisotropies in the Cosmic Dawn and EoR 21-cm power spectrum

Suman Majumdar, Kanan K. Datta, Raghunath Ghara, Rajesh Mondal , T. Roy Choudhury, Somnath Bharadwaj, Sk Saiyad Ali, Abhirup Datta, accepted in Journal of Astrophysics and Astronomy (SKA-India special issue), 2016