List of publications

- **Published manuscripts:**

  1. 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).
  2. 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).
  3. 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).
  4. 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:**

  1. Bridging the gap between Cosmic Dawn and Reionization favors Faint Galaxies-dominated 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].
  2. 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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Appendix

As given in equation 3.1, the differential halo mass function can be written as,

$$\frac{dn(M,z)}{dM} = \frac{\bar{\rho}_0}{M} f(\sigma) \left| \frac{d\ln\sigma}{dM} \right| . \tag{1}$$

The RMS linear overdensity of the density field $\sigma^2(M) = \frac{b^2(z)}{2\pi^2}\int_0^\infty k^2 P(k) W^2(k;M) dk$ or, $\sigma(z,M) = b(z)\sigma_0$, where, $W(k;M)$ is the Fourier Transform of the real space top-hat filter, $P(k)$ is the linear power spectrum of the density fluctuations (at $z = 0$) and $b(z)$ is the growth factor normalized to unity at $z = 0$ (Peebles, 1993) and can be written in terms of cosmological parameters as (Padmanabhan, 2002),

$$b(z) = \left[\frac{\Omega_m + 0.4545\Omega_\Lambda}{\Omega_m(1+z)^3 + 0.4545\Omega_\Lambda} \right]^{1/3} . \tag{2}$$

The mass function, $f(\sigma)$ is defined as the fraction of mass in collapsed halos per unit interval in mass variable $ln\sigma^{-1}$. The Sheth-Tormen mass function can be expressed as,

$$f_{ST}(\sigma) = A\sqrt{\frac{2a}{\pi}} \frac{\delta_c}{\sigma} \left[1 + \left(\frac{\sigma^2}{a\delta_c^2} \right)^p \right] \exp\left(-\frac{a\delta_c^2}{2\sigma^2} \right) . \tag{3}$$

Now using equation 3, equation 1 can be written as,

$$\frac{dn}{dM} = \frac{\bar{\rho}_0}{M} A\sqrt{\frac{2a}{\pi}} \frac{\delta_c}{b(z)\sigma_0} \left[1 + \left(\frac{b^2(z)\sigma_0^2}{a\delta_c^2} \right)^p \right] \exp\left(-\frac{a\delta_c^2}{2b^2(z)\sigma_0^2} \right) \left| \frac{1}{\sigma_0} \frac{d\sigma_0}{dM} \right| . \tag{4}$$

So, the redshift derivative of the differential halo mass function is given by,

$$\begin{aligned}
\frac{d^2n}{dzdM} &= \frac{\bar{\rho}_0}{M} A\sqrt{\frac{2a}{\pi}} \frac{\delta_c}{b(z)\sigma_0} \exp\left(-\frac{a\delta_c^2}{2b^2(z)\sigma_0^2} \right) \left| \frac{1}{\sigma_0} \frac{d\sigma_0}{dM} \right| \left\{ \left[1 + \left(\frac{b^2(z)\sigma_0^2}{a\delta_c^2} \right)^p \right] \right. \\
&\quad \left. \times \left(-\frac{\dot{b}(z)}{b(z)} \right) + \left(\frac{b^2(z)\sigma_0^2}{a\delta_c^2} \right)^p \times 2p \frac{\dot{b}(z)}{b(z)} + \left[1 + \left(\frac{b^2(z)\sigma_0^2}{a\delta_c^2} \right)^p \right] \left(\frac{a\delta_c^2}{b^2(z)\sigma_0^2} \right) \frac{\dot{b}(z)}{b(z)} \right\} \\
&= \frac{\bar{\rho}_0}{M} A\sqrt{\frac{2a}{\pi}} \frac{\delta_c}{\sigma_0} \exp\left(-\frac{a\delta_c^2}{2b^2(z)\sigma_0^2} \right) \left| \frac{1}{\sigma_0} \frac{d\sigma_0}{dM} \right| \frac{\dot{b}(z)}{b^2(z)} \\
&\quad \times \left\{ 2p \left(\frac{b^2(z)\sigma_0^2}{a\delta_c^2} \right)^p + \left[1 + \left(\frac{b^2(z)\sigma_0^2}{a\delta_c^2} \right)^p \right] \times \left[\left(\frac{a\delta_c^2}{b^2(z)\sigma_0^2} \right) - 1 \right] \right\}
\end{aligned} \tag{5}$$

This gives the redshift derivative of the differential halo mass function discussed in Chapter 3.