

Inferring Cosmology & Astrophysics from the 21-cm Signal with SKA-Low

ML and the SKA for Cosmic Dawn & the Epoch of Reionization

Michele Bianco
ETH zürich

Inferring Cosmology and Astrophysics from the High-redshift 21cm Signal with SKA-Low

Anshuman Acharya^{1,2}, Satadru Bag^{1,3}, Sabrina Berger^{4,5}, Michele Bianco^{6,7}, Daniela Breitman⁸, Lilian Crascall-Kennedy⁹, Saswata Dasgupta^{10,11}, Abhirup Datta¹², Marian Douspis⁹, Ivelin Georgiev^{13,14}, Sambit K. Giri^{13,15}, Adélie Gorce⁹, Caroline Heneka¹⁶, Julien Hiegel¹⁷, Ian Hothi¹⁸, Akanksha Kapahtia¹⁹, Nicholas Kern²⁰, Yashrajsinh Mahida¹², Barun Maity¹⁹, Suman Majumdar¹², Romain Mériot²¹, Rajesh Mondal²², Steven G. Murray^{8,23}, Leon Noble¹², Samit Kumar Pal¹², Aurel Schneider²⁴, Benoît Semelin²⁵, Abinash Kumar Shaw^{1,26}, Hayato Shimabukuro^{27,28,29}, Emilie Thélie³⁰, Anshuman Tripathi¹² and Cathryn M. Trott^{4,31,32}

[arXiv: 2606.27858](https://arxiv.org/abs/2606.27858)

Machine Learning and the SKA for Cosmic Dawn and the Epoch of Reionization

Anshuman Acharya^{7,13}, Michele Bianco^{9,10}, Daniela Breitman¹¹, Huaxi Chen¹⁸, Abhirup Datta¹, Kangning Diao^{13,14}, Sambit K. Giri^{2,3}, Caroline S. Heneka¹², Nicholas Kern⁴, Adrian Liu¹⁹, Yashrajsinh Mahida¹, Suman Majumdar¹, Samit Kumar Pal¹, Shulei Ni¹⁸, Yannic Pietschke¹², Davide Piras⁵, Abinash Kumar Shaw^{6,7}, Hayato Shimabukuro^{15,16,17}, Ce Sui¹⁴, Anshuman Tripathi¹ and Xiaosheng Zhao⁸

[arXiv: 2607.03606](https://arxiv.org/abs/2607.03606)

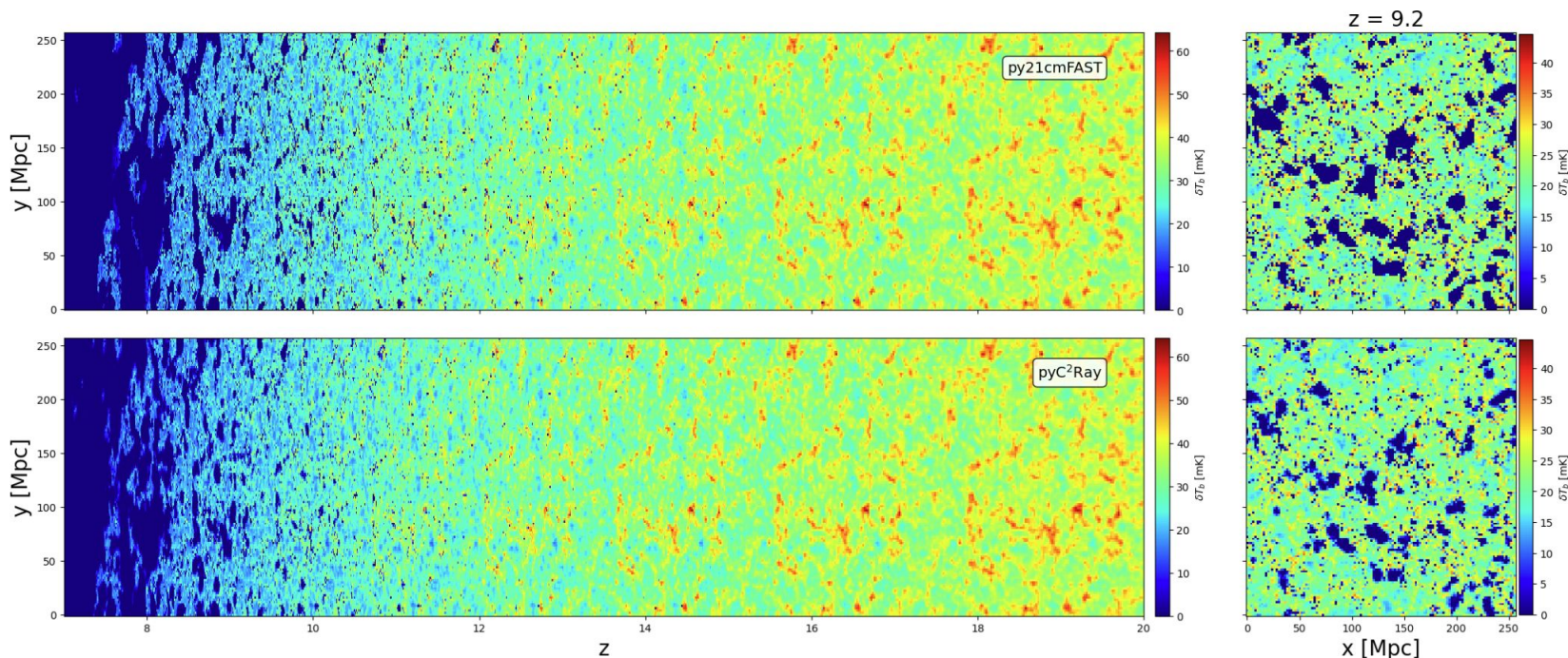
ML and the SKA for CD and EoR

SKA will generate unprecedented amounts of data with opportunities for novel data driven algorithms that unlock new methods for understanding the high-z universe.

- Observation:
 - Radio Frequency Interference (RFI)
 - Correction of ionospheric effect
 - Gain calibration
 - Imaging process
 - Foreground mitigation
- Theory:
 - Accelerating & improving Simulation at the field level
 - Emulators of Summary statistics
- Inference:
 - Auxiliary data production from images
 - **Parameter inference**

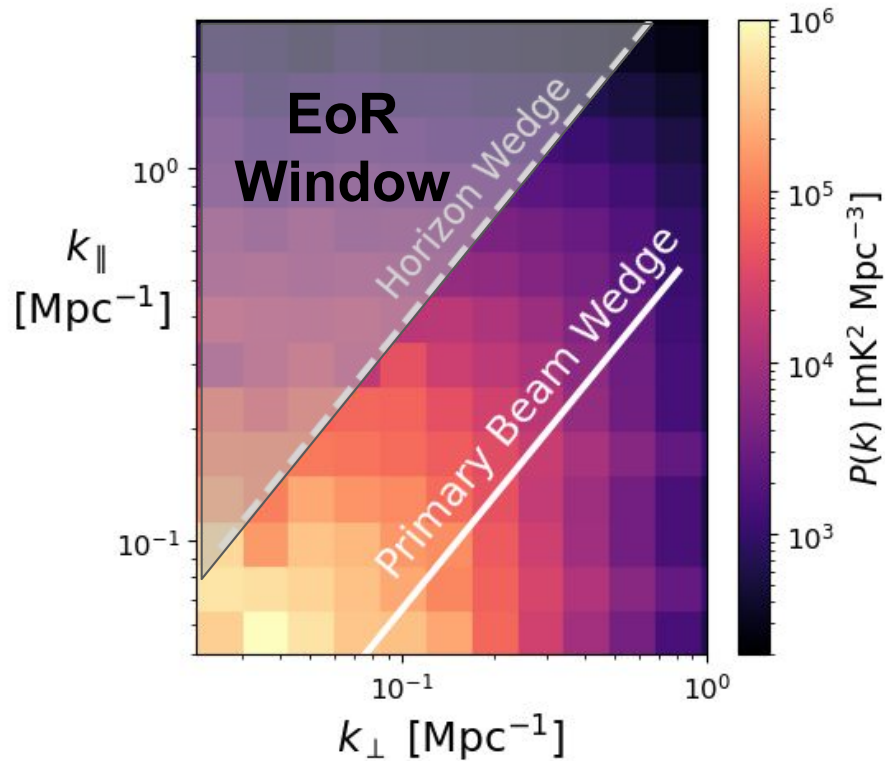
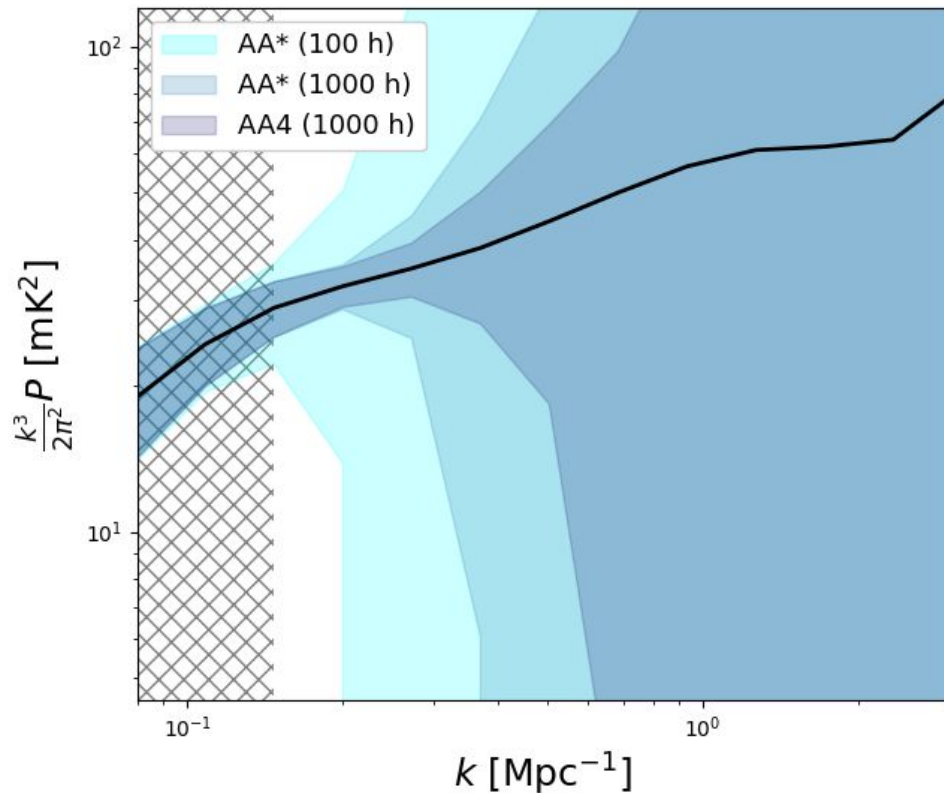
Inferring from the 21cm Signal with SKA-Low

Inference is strongly bias based on simulation methods employed to simulate the 21-cm signal during CD/EoR (e.g. analytical, semi-numerical, numerical, emulators)

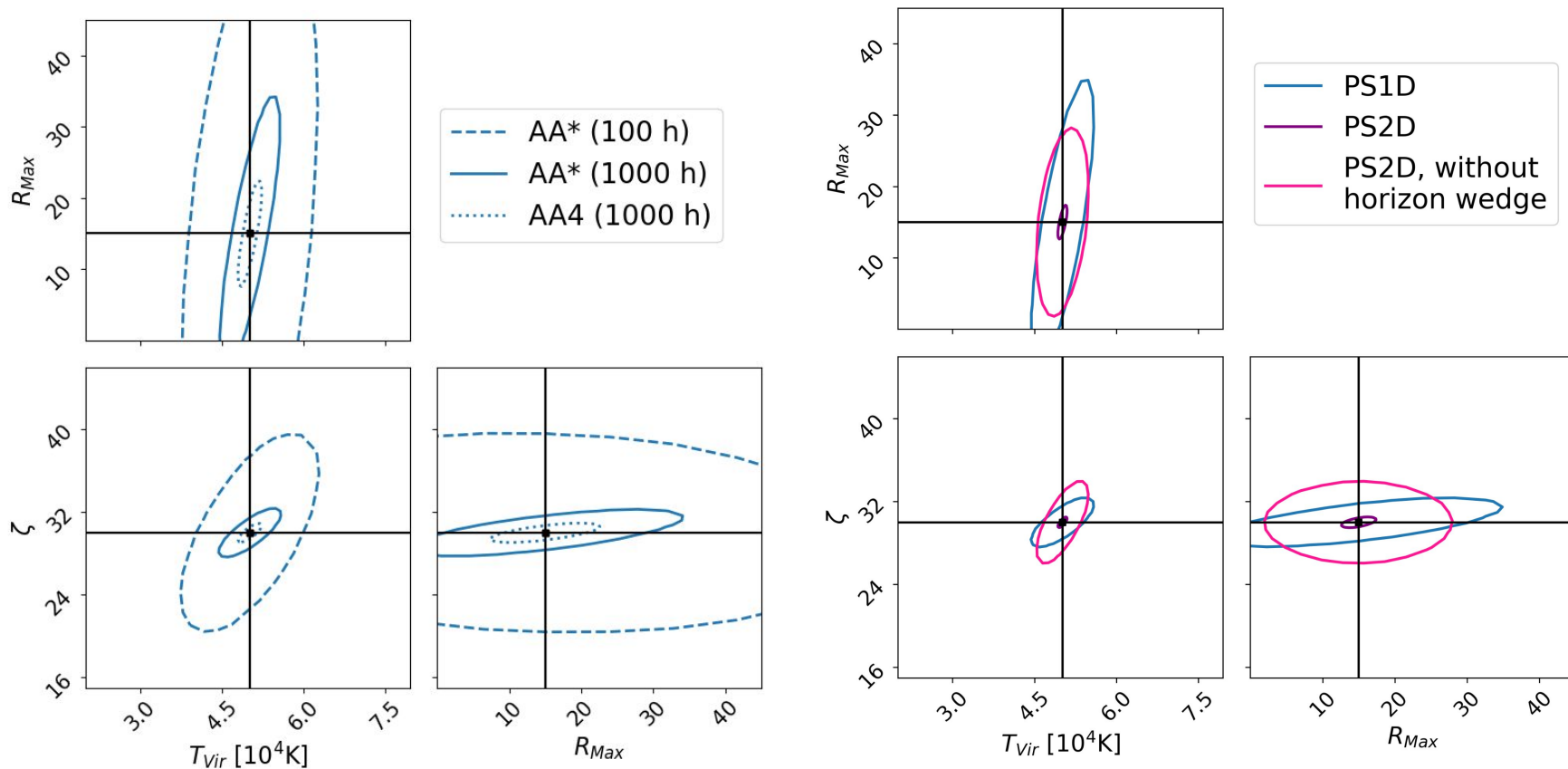


For reference see upcoming publication on the SDC3b (Bonaldi et al. 2027)

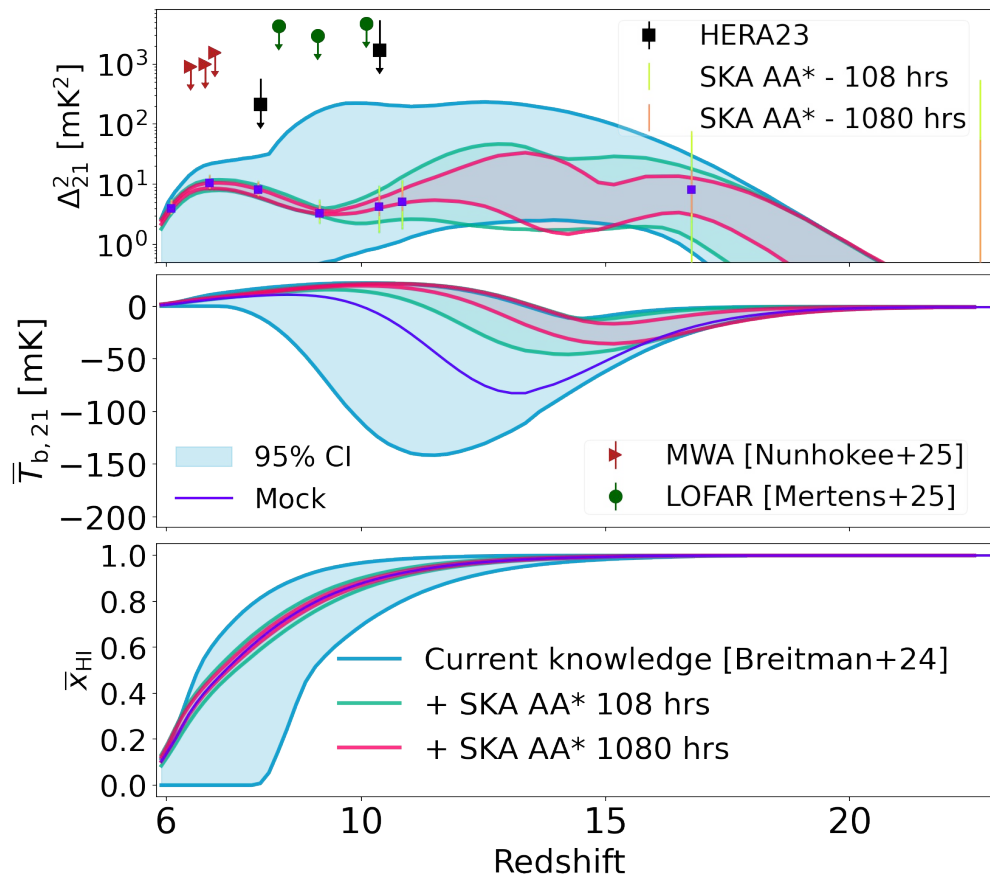
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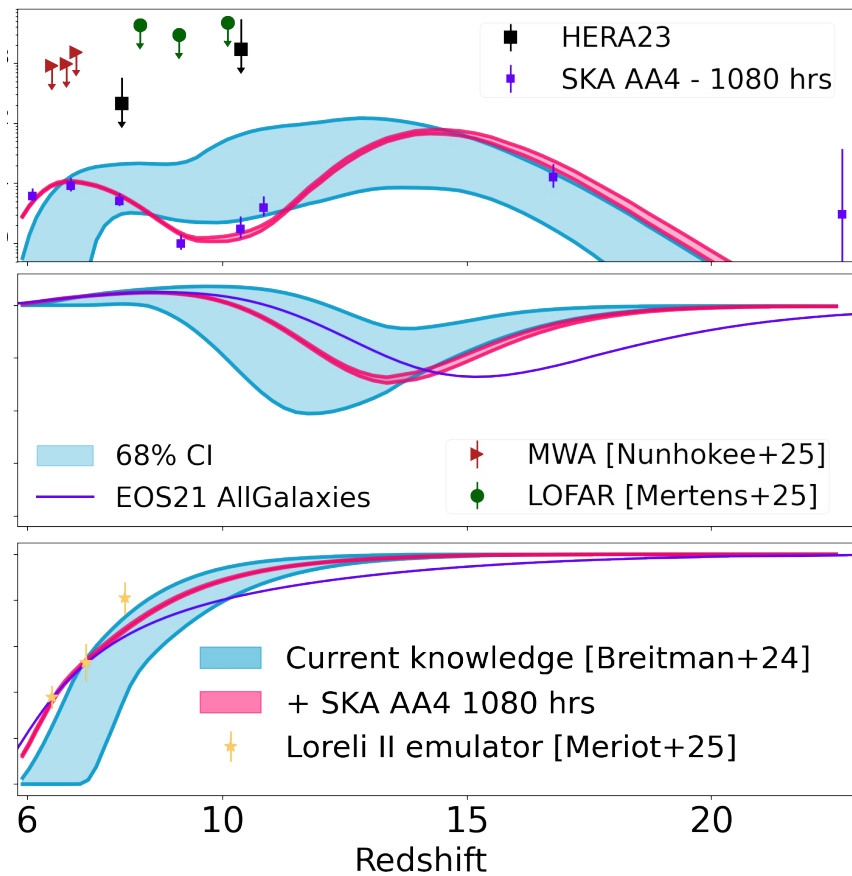
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Inference from emulators on mock observations

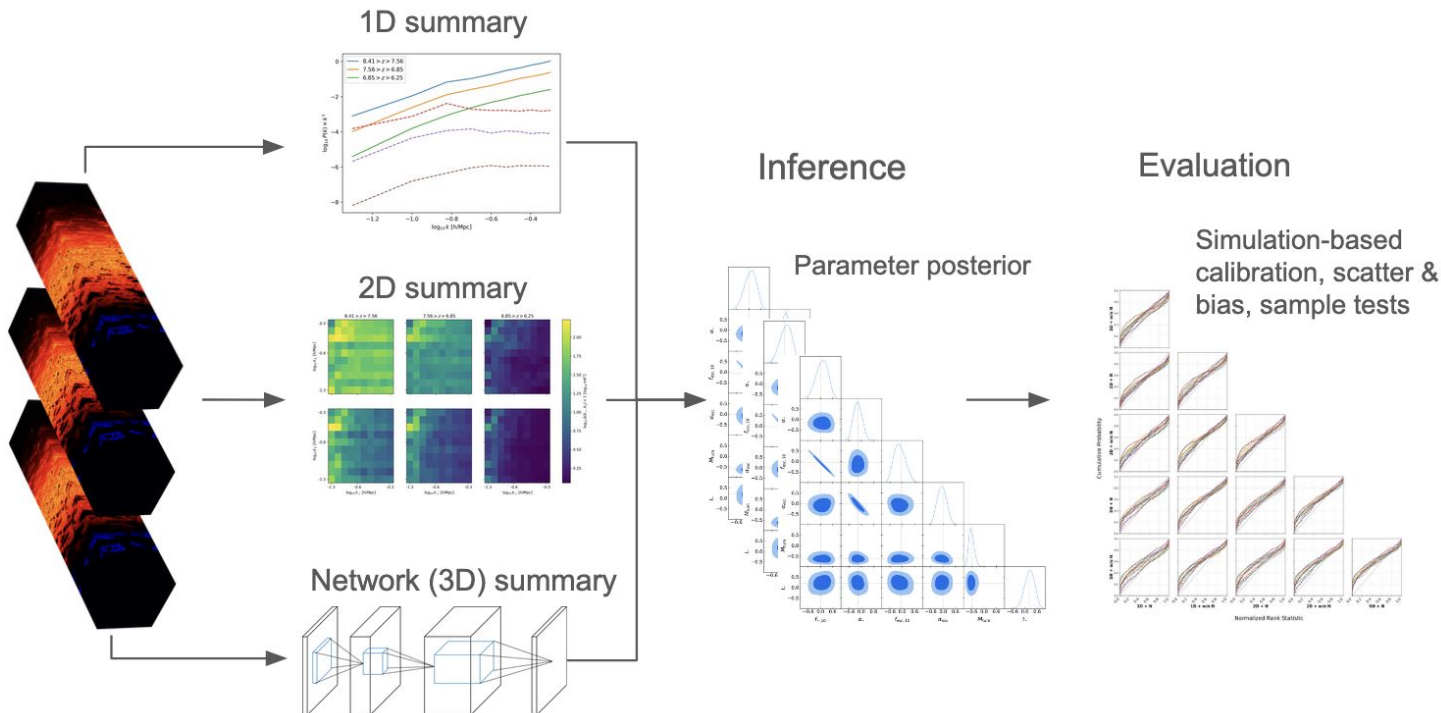


...including a different mock SKA-Low observations



ML and the SKA for CD and EoR

Alternative inference methods such as SBI can provide better astrophysical & cosmological constraints by combining multiple summary statistics [Cerardi et al \(2025\)](#)



Conclusion and Summary

- The fast growing field of ML finds its application in several domains of SKA
 - e.g. RFI, ionospheric effect, gain calibration, foreground mitigation, improving simulations, emulators, parameter inference, etc.
- Extracting robust astrophysical and cosmological constraints from SKA-Low 21-cm data requires accurate signal models and no single approach can capture all relevant processes with both accuracy and efficiency (e.g. Fisher forecast test)
- Flexible inference methods such as SBI offer a more robust alternatives that can handle systematics and foreground contaminations effects.