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Reionization and the Cosmic Dawn: ongoing activities towards the SKA

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The birth of the first stars, black holes and galaxies heralded the end of the cosmic Dark Ages and the beginning of the Cosmic Dawn. The light from these objects heated and ionized almost every atom in existence, culminating in the Epoch of Reionization: the final major phase change of the Universe. This final frontier of astrophysical cosmology is undergoing a transition from an observationally-starved epoch to a "Big Data" field. This process is set to culminate with upcoming Square Kilometre Array observations of the redshifted 21-cm line: providing a 3D map of the first billion years of our Universe. Currently, we are starting to get a handle on the timing of reionization. However with the SKA, we will be able to actually study the UV and X-ray properties of the first galaxies, which are encoded in the large-scale structure of the H I signal. I will discuss the innovative modeling techniques we are developing to tap into this bounty, allowing us to constrain astrophysical parameters in a fully Bayesian framework. With this framework, we can infer the star formation inside galaxies too faint to be seen even with JWST. Moreover, we can study high-energy processes in the early Universe, through their heating signature of the IGM before reionization. With SKA, the Italian astronomical community is in the position to become a world leader in the study of Reionization and the Cosmic Dawn.

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