Lyman alpha emission as a probe of the high redshift Universe

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Abstract

The Epoch of Reionization (EoR) is one of the last unknown phases in the evolution of our Universe, signaling the birth of the first stars and the consequent ionization of the hydrogen in the intergalactic medium. The process is hard to be characterized by galaxy surveys since most galaxies responsible for reionization are too faint to be directly observed. As an alternative we propose to use three dimensional intensity mapping of lyman alpha emission as a probe of the astrophysical conditions during the EoR. The hydrogen Lyman alpha line is one of the most intense emission lines in galaxies spectra and has now been observed in a large range of redshifts. We estimate the alloud range of intensities and spatial fluctuations in lyman alpha emission from both galaxies and the IGM, taking into account the astrophysical processes involved in the line emission and observational constraints in Lyman alpha LFs and in the star formation rate density (SFRD). We also consider, the possibility of at lower redshifts ($z \sim 2-3$) applying the same technique to probe the evolution of the SFRD during its peak. Foreground contamination studies are presented for the Lyman alpha line and several experimental setups. Moreover, we explore the possibility of cross correlating lyman alpha intensity maps with HI intensity maps as a way of avoiding foreground contamination.