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Fundamental physics from the cosmological 21 cm radiation[1]
RISHI KHATRI, BENJAMIN WANDELT, University of Illinois at Urbana-Champaign — New low frequency radio telescopes currently being built open up the possibility of observing the 21 cm radiation before the Epoch of Reionization in the future, in particular at redshifts $\sim 30 < z < 200$, also known as the dark ages. At these high redshifts, Cosmic Microwave Background (CMB) radiation is absorbed by neutral hydrogen at its 21 cm hyperfine transition. This redshifted 21 cm signal thus carries information about the state of the early Universe and can be used to test fundamental physics. We study two types of new physics which such observations can constrain. 1) We show that the 21 cm radiation is very sensitive to the variations in the fine structure constant and can in principle place constraints comparable to or better than the other astrophysical experiments. 2) Cosmic strings, if they exist, contribute to the anisotropies in the primordial gas leaving an imprint on the 21 cm radiation. We show that the 21 cm radiation can probe the entire parameter space predicted by the brane-inflation scenarios of superstring theory. Making such observations will require radio telescopes of collecting area $10^2 - 10^6$ km^2 compared to ~ 1 km^2 of current telescopes.

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