Revisiting constraints on superconducting cosmic strings in light of Dark Ages global 21-cm signal

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The Superconducting Cosmic Strings (SCS) are a special case of cosmic strings that have a core carrying a charged field. When SCS pass through magnetized regions, the charged particles in the string experience a Lorentz force, which can produce radiation on the entire electromagnetic spectrum. This radiation can inject energy into the plasma, resulting in a modification of the thermal and ionization evolution of the intergalactic medium (IGM) and, subsequently, the global 21-cm signal. The signatures of SCS in the post-recombination era have been primarily studied in the low-frequency (radio) regime, which does not impact the state of the IGM. In this work, we study the effect of decaying SCS on the Dark Ages global 21-cm signal (δTb), considering both the ionizing and radio radiations. The Dark Ages signal can provide pristine cosmological information free from astrophysical uncertainties, as the universe was primarily homogeneous during this era in the absence of baryonic structure formation. Considering a change in the δTb at redshift $z \sim 89$ from the ΛCDM framework to be 5 mK and 15 mK, we derive an upper bound on the loop current of cosmic string, $I \gtrsim 11.5$ GeV, and string tension, $G\mu s \gtrsim 2.5 \times 10{-}15$.