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CTA perspective for the gamma-ray luminosity–SFR correlation in star-forming galaxies

Star-forming galaxies (SFGs) are unique gamma-ray emitters. The observation of a correlation between their non-thermal luminosity and their star-formation rate (SFR) strongly suggests that these gamma rays result from interactions of cosmic rays injected by phenomena connected with the SFR, such as supernova remnants and massive star winds.
We aim to investigate the effect of gamma-ray absorption processes and cosmic-ray transport footprints in SFGs at very high energies (VHE) in terms of the luminosity-SFR correlations.
We develop a model that reproduces the non-thermal emission in SFGs from radio to GeV, using the SFR as an independent variable. We build the correlation by integrating the luminosity in two energy bands that will be accessible to CTA: 0.1-10 TeV and 10 -100 TeV.
We explore how particles diffusion, protons' maximum energy, and the absorption inside galaxies and en route to Earth impact the modeled correlation.
We find that these properties substantially impact the correlation in the highest energy range and provide key information on particle transport.
In light of upcoming CTA observations, we conclude by discussing how the luminosity-SFR correlation in the VHE band can guide us in improving our understanding of CR transport and radiative processes in SFGs.

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