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Extending Cosmic Ray Background in the LiteBIRD Experiment using Generative Adversarial Networks

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Cosmic rays (CR) reaching telescope detectors in outer space are known to induce glitches and background noise, as the High-Frequency Telescope (HFT) of the LiteBIRD experiment, designed to measure the B modes polarization of the Cosmic Microwave Background (CMB). The presence of CR noise significantly influenced the Planck experiment, which shared similarities in detector design with LiteBIRD. Detecting the faint CMB signal excluding data affected by CR noise from analysis is impractical. In order to address this challenge, it is imperative to accurately simulate the CR background throughout the duration of LiteBIRD's three-year mission. However, state-of-the-art Monte Carlo simulations of CR background incur significant computational overhead, typically requiring 30 times the simulated period, rendering complete coverage of the mission infeasible. To overcome this limitation, we propose augmenting Monte Carlo simulations with Generative Adversarial Networks (GANs). By leveraging GANs, we can efficiently generate a sufficient number genuine, statistically independent images, unlike traditional noise analysis techniques together with template expansion methods.

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