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Can Axions Put Out Gamma-ray Bursts?

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Short gamma-ray bursts (GRBs) are some of the brightest transients in the universe. We show that heavy axion-like particles (ALPs) can be produced in the hot plasma of GRB fireballs. When produced in the earliest stages, they escape and decay outside the source. We demonstrate that the resulting prompt photon field arising from ALP decay is too rarefied to re-thermalize, effectively preventing the re-emergence of the fireball, thus dimming or disrupting GRBs. In the later stages of the evolution of the expanding fireball, hadronic interactions become important and radiative transfer from decaying ALPs can lead to a diffuse contribution to various cosmic backgrounds through cascades, among other signatures. Using existing observations of short GRBs, we place competitive bounds reaching ALP-photon couplings of $g_{a\gamma\gamma} \sim 4x10^{-12}$ GeV^{-1} for ALP masses between 200 MeV and 5 GeV.

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