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Radiative Relativistic Collisionless Plasma Turbulence as a Frontier of Extreme Plasma Astrophysics[1] DMITRI UZDENSKY, University of Colorado, Boulder, VLADIMIR ZHDANKIN, Princeton University, GREGORY WERNER, University of Colorado, Boulder, MITCHELL BEGELMAN, University of Colorado, Boulder; JILA — We are entering a new era when first-principles computational and theoretical studies of complex collective plasma processes under extreme conditionsmarked by the importance of relativistic, radiation, and pair-production effectsare becoming feasible and even routine. These studies, motivated by our desire to understand plasma behaviors around exotic astrophysical objects like neutron stars and black holes, form the new field of Extreme Plasma Astrophysics. One of the most exciting frontiers in this emerging field is radiative turbulence, where turbulent energy injection is balanced by radiative cooling. We present the results of our radiative particle-in-cell simulations of driven kinetic turbulence in a relativistic pair plasma with optically thin inverse-Compton cooling. We find that radiation quenches nonthermal particle acceleration, effectively thermalizing the plasma. The high-energy particle distributions are strongly anisotropic, leading to potentially observable intermittent beaming. The anisotropy, spatial inhomogeneity, and temporal variability of the high-energy emission are more extreme at high magnetizations, when bulk fluid motions become relativistic. These findings help us understand astrophysical gamma-ray flares and advance Extreme Plasma Astrophysics.

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