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Extreme two-temperature plasmas in kinetic simulations of radiative relativistic turbulence[1] VLADIMIR ZHDANKIN, Princeton University, DMITRI UZDENSKY, University of Colorado at Boulder, MATTHEW KUNZ, Princeton University — Turbulence energizes electrons and ions in collisionless astrophysical plasmas, such as hot accretion flows onto black holes, and thus shapes their radiative signatures (luminosity, spectra, and variability). To understand the kinetic properties of a collisionless radiative plasma subject to externally driven turbulence, we investigate particle-in-cell simulations of relativistic plasma turbulence with external inverse Compton cooling acting on electrons. We find that ions continuously heat up while electrons gradually cool down (due to the net effect of radiation). Thus, the ion-to-electron temperature ratio T_i/T_e grows in time and is limited only by the size and duration of the simulations, indicating the absence of efficient collisionless mechanisms of electron-ion thermal coupling. Electrons acquire a quasi-thermal distribution (dictated by the competition of turbulent energization and radiative cooling), while ions undergo efficient nonthermal acceleration. There is a modest nonthermal population of high-energy electrons that are beamed intermittently, which may explain rapid high-energy flares in certain astrophysical systems. These results show that extreme two-temperature plasmas are produced and maintained by relativistic radiative turbulence.

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