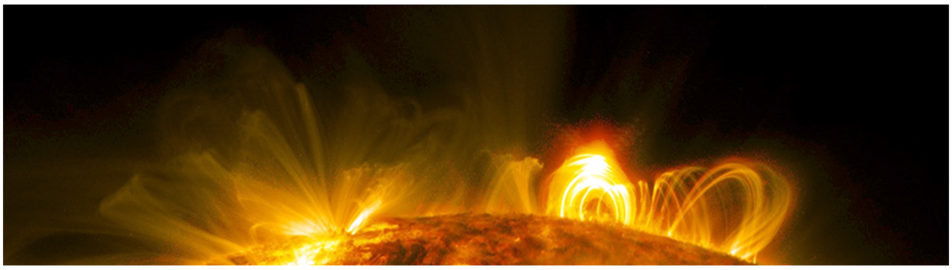

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The Interplay of Magnetically Dominated Turbulence and Magnetic Reconnection in Accelerating Particles

Tuesday, 16 November 2021 10:30 (15 minutes)

Nature's most powerful high-energy sources are capable of accelerating particles to high energy and radiate it away on extremely short timescales, even shorter than the light crossing time of the system. It is yet unclear what physical processes can produce such an efficient acceleration, despite the copious radiative losses. By means of fully-kinetic particle-in-cell simulations that include self-consistently the radiation reaction force, we investigate the acceleration and cooling of particles in turbulent plasmas subject to strong synchrotron cooling. We show that reconnecting current sheets, which develop self-consistently in the turbulent plasma, inject particles with a hard power-law distribution and low pitch angle. Particles cool down by increasing their pitch angle, which affects the cooled particle distribution. Due to the low pitch angle of the accelerated particles, significant synchrotron radiation is emitted above the synchrotron burnoff limit. Synchrotron radiation from the accelerated particles give rise to a synchrotron energy flux with a power-law range $\nu F_\nu \propto \nu^s$ with $s \sim 1$, up to the peak frequency $\nu_{\rm peak}$. Our findings have important implications for understanding the nonthermal emission from high-energy astrophysical sources, most notably the prompt phase of gamma-ray bursts and gamma-ray flares from the Crab nebula.

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