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A simulation of flare-driven coronal rain

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Coronal rains are cool materials (~10,000 K) that appear at hot corona. They are frequently observed in non-flaring loops of active regions and recently observed in flaring loops at gradual phases. Hot coronal loops (~10 MK) are often produced in flare events due to magnetic reconnection. The hot flare loops gradually recover to typical coronal temperature due to thermal conduction and radiative loss, during which condensation can happen due to thermal instability. Here we demonstrate how the rains formed in a flare loop with a two-and-a-half dimensional magnetohydrodynamic simulation. We simulate a flare event from pre-flare phase all the way to gradual phase and successfully reproduce coronal rains. We find that thermal conduction and radiative losses alternately dominate the cooling of the flare loop. We find that runaway cooling and rain formation also induce the appearance of dark post-flare loop systems, as observed in extreme ultraviolet (EUV) channels.