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Relativistic electron flux enhancement during a weak geomagnetic storm

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The relatively weak magnetic storm in April 2017, with SYM-H reaching only -50nT, resulted in a two orders of magnitude enhancement of relativistic and ultra–relativistic electrons. This impressive enhancement is comparable to the St. Patrick's event in 2015, an extreme storm with SYM-H reaching -235nT. The April 2017 enhancement appeared at energies up to 10 MeV, and was long-lived, lasting for more than 20 days. Nevertheless, the enhancement of super-relativistic electrons (>6 MeV) was not recorded by geosynchronous spacecraft, which collect most of our space weather alert data. The analysis of radial profiles of the electrons' phase space density, combined with radial diffusion simulations, shows that the enhancement of relativistic and ultra–relativistic electrons was caused by synergetic subsequent mechanisms: first, a series of intense substorms provided seed electrons and drove the growth of whistler mode chorus waves; second, the chorus waves accelerated the seed electron population to relativistic energies; third, the relativistic electrons were further accelerated to ultra–relativistic energies through inward diffusion driven by Pc5 ULF waves, which persisted throughout the magnetic storm duration.