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Comparing and contrasting dispersionless injections at geosynchronous orbit during a substorm event

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Particle injections in the magnetosphere transport electrons and ions from
the magnetotail to the radiation belts. We consider generation mechanisms of “dispersionless” injections, namely those with simultaneous increase of the particle flux over a wide energy range. We take advantage of multi-satellite observations which simultaneously monitor Earth’s magnetospheric dynamics from the tail towards the radiation belts during a substorm event. Dispersionless injections are associated with instabilities in the plasma sheet during the growth phase of the substorm, with a dipolarization front at the onset and with magnetic flux pileup during the expansion phase. They show different spatial spread and propagation characteristics. At geosynchronous orbit (6.6 RE), the electron distributions do not have a classic power law fit but instead a bump-on-tail centered on $\sim$120 keV during dispersionless electron injections. However, electron distributions of injections associated with magnetic flux pileup in the magnetotail (13 RE) do not show such a signature. We surmise that an additional resonant acceleration occurs in-between these locations. We relate the acceleration mechanism to the electron drift resonance with ultralow frequency (ULF) waves localized in the inner magnetosphere. This study is supported by the Volkswagen Foundation.