A Missing Dusk-side Loss Process in the Electron Ring Current

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The terrestrial electron ring current, a circular flow of charged particles trapped by the Earth's magnetic field, exhibits enhanced activity during geomagnetic storms. Despite extensive research, the mechanisms driving this enhancement remain unclear due to the complex dynamics involved. This study reveals that existing models of the ring current overestimate electron flux on the nightside during storm onset, primarily due to a missing loss process operating in the pre-midnight sector. By analyzing electron drift trajectories, we demonstrate that accurate reproduction of observations requires the loss process to reach the theoretical upper limit over a broad region in space. Understanding these processes is crucial for accurately simulating the ring current's behavior during geomagnetic storms and its impact on Earth's magnetic field and space environment.

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