3D current systems in the magnetosphere due to energetic particle precipitation

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Intense precipitations of energetic charged particles into the ionosphere occur during magnetic storms. These precipitations are due to the cyclotron instability developing under the interaction of newly injected energetic particles with detached plasma regions. Such precipitation results in formation of a specific 3D current system, which ensures the quasineutrality condition for the ionospheric and magnetospheric plasmas. The development of this current system is accompanied with generation of a northward electric field and formation of the ionospheric trough at the footpoints of the low-latitude edge of the partial ring current.