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Generation of Currents in Weakly Ionized Plasmas through a Collisional Dynamo[1] YAKOV DIMANT, MEERS OPPENHEIM, ALEX FLETCHER, Boston Univ — Intense electric currents called electrojets occur in weakly ionized magnetized plasmas. An example occurs in the Earth's ionosphere near the magnetic equator where neutral winds drive the plasma across the geomagnetic field. Similar processes take place in the Solar chromosphere and MHD generators. We argue that not all convective neutral flows generate electrojets and it introduces the corresponding universal criterion for the current formation, $\nabla \times (\vec{U} \times \vec{B}) \neq \partial \vec{B}/\partial t$, where $\vec{U}$ is the neutral flow velocity, $\vec{B}$ is the magnetic field, and t is time. This criterion does not depend on the conductivity tensor, $\hat{\sigma}$. For many systems, the displacement current, $\partial \vec{B}/\partial t$, is negligible, making the criterion even simpler. This theory also shows that the neutral-dynamo driver that generates electrojets plays the same role as the DC electric current plays for the generation of the magnetic field in the Biot-Savart law.

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