We have derived the advection of magnetic fields in plasmas, due to gradients in diffusivity, for a completely general case. Magnetic diffusivity is proportional to electrical resistivity. Where the value of this parameter is high, it is well known that magnetic fields can leak (or diffuse) rapidly into (or out) of the plasma. Where gradients are high, i.e. the diffusivity changes rapidly in space, magnetic fields can experience enhanced advection. We also find that this diffusivity-gradient-driven magnetic advection can be expressed in terms of a diffusion equation within the induction equation, making its computational implementation simpler.

We derive the phenomenon rigorously, and discuss its implications for the solar dynamo. We present preliminary results of simulations of the effect generated with a magnetohydrodynamic model.

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