

Abstract Submitted  
for the DPP13 Meeting of  
The American Physical Society

**Asymmetric Diffusion of Magnetic Field Lines** ANDREY BERES-  
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mas move preferentially along magnetic field lines. The perpendicular transport and  
mixing are suppressed in quiet, laminar plasmas. In turbulent plasmas, however,  
magnetic field lines are stochastic and this accounts for a big part of perpendicular  
transport. Magnetic field lines separate faster than diffusively in turbulent plasma,  
which is called superdiffusion. Furthermore, we discovered that this superdiffusion  
is, in general, asymmetric, so that the separation of field lines along the magnetic  
field direction is different from the separation in the opposite direction, if the symme-  
try of the flow is broken by the so-called imbalance or cross-helicity. The difference  
between forward and backward diffusion, however, is not directly due to imbalance,  
but a non-trivial consequence of both imbalance and non-reversibility of turbulence.  
The asymmetric diffusion perpendicular to the mean magnetic field entails a variety  
of new physical phenomena, such as the production of parallel particle streaming in  
the presence of perpendicular gradients. Such streaming and associated instabilities  
are important for particle transport in laboratory, space, and astrophysical plasmas.

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Date submitted: 11 Jul 2013

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