



Flux Expulsion and Dynamos

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In this talk, I will discuss interactions some important recent advances in dynamo theory and magnetic flux expulsion. Particular emphasis will be given to the role of the Lorentz force in setting the ultimate state of the homogenization and the role of magnetic helicity conservation for the saturation of dynamos.

Since the early pioneering calculations of Weiss (1966), flux expulsion has played a key role in our understanding of the interaction of convective flows and magnetic field. Here we examine the role of the Lorentz force in modifying the conservation of circulation and Kelvin's Theorem. This plays a key role in modifying the transport of the flow. A related problem is that of generation of large-scale magnetic field by dynamo action. We examine whether helicity expulsion from the dynamo domain can lead to alleviation of the Vainshtein-Cattaneo/Gruzinov-Diamond catastrophic quenching, and whether there is hope for generation of large-scale magnetic fields at high magnetic Reynolds number.

References

Weiss, N.O., The expulsion of magnetic flux by eddies, Proceedings of the Royal Society of London A, 293, 1934 (1966)