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Generation of large-scale magnetic fields by small-scale dynamo in shear flows[1] JONATHAN SQUIRE, AMITAVA BHATTACHARJEE, Princeton Plasma Physics Laboratory — A new mechanism for turbulent mean-field dynamo is proposed, in which the magnetic fluctuations resulting from a small-scale dynamo drive the generation of large-scale magnetic fields. This is in stark contrast to the common idea that small-scale magnetic fields should be harmful to large-scale dynamo action. These dynamos occur in the presence of large-scale velocity shear and do not require net helicity, resulting from off-diagonal components of the turbulent resistivity tensor as the magnetic analogue of the "shear-current" effect. The dynamo is studied using a variety of computational and analytic techniques, both when the magnetic fluctuations arise self-consistently through the small-scale dynamo and in lower Reynolds number regimes. Given the inevitable existence of non-helical small-scale magnetic fields in turbulent plasmas, as well as the generic nature of velocity shear, the suggested mechanism may help to explain generation of large-scale magnetic fields across a wide range of astrophysical objects.

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