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Not Much Helicity is Needed to Drive Large Scale Dynamos¹ JONATHAN PIETARILA GRAHAM, Los Alamos National Laboratory, ERIC BLACKMAN, University of Rochester, PABLO MININNI, Universidad de Buenos Aires, National Center for Atmospheric Research, ANNICK POUQUET, National Center for Atmospheric Research — Understanding the in situ amplification of large scale magnetic fields in turbulent astrophysical rotators has been a core subject of dynamo theory. When turbulent velocities are helical, large scale dynamos that substantially amplify fields on scales that exceed the turbulent forcing scale arise, but the minimum sufficient fractional kinetic helicity $f_{h,C}$ has not been previously well quantified. Using direct numerical simulations for a simple helical dynamo, we show that $f_{h,C}$ decreases as the ratio of forcing to large scale wave numbers k_F/k_{min} increases. From the condition that a large scale helical dynamo must overcome the backreaction from any non-helical field on the large scales, we develop a theory that can explain the simulations. For $k_F/k_{min} \geq 8$ we find $f_{h,C} < 3\%$, implying that very small helicity fractions strongly influence magnetic spectra for even moderate scale separation.

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