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**Effects of magnetic and kinetic helicities on the growth of magnetic fields in laminar and turbulent flows by helical-Fourier decomposition**[1] MORITZ LINKMANN, GANAPATI SAHOO, University of Rome Tor Vergata, MAIRI MCKAY, ARJUN BERERA, University of Edinburgh, LUCA BIFERALE, University of Rome Tor Vergata — We perform an analytical and numerical study of incompressible homogeneous conducting fluids by Fourier-helical decomposition of the equations of magnetohydrodynamics (MHD) and a subsequent reduction of the number of degrees of freedom. From the stability properties of the most general subset of interacting velocity and magnetic fields on a closed Fourier triad, we make predictions on the large-scale magnetic-field growth depending on the distribution of magnetic and kinetic helicities among the three wavenumbers. In the kinematic dynamo regime we predict the formation of a large-scale magnetic component with a magnetic helicity of opposite sign with respect to the kinetic helicity, a sort of triadic-by-triad $\alpha$-effect in Fourier space, while in presence of strong small-scale magnetic helicity we predict an inverse cascade of magnetic helicity. We confirm these predictions through a series of Direct Numerical Simulations, either seeding different magnetic helical components in a strongly helical flow (turbulent/laminar) or directly injecting helical magnetic fluctuations at small scales. Our results show that important dynamical features of MHD flows can be predicted from an analytically tractable dynamical system derived directly from the MHD equations.

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