C T2 Simulations of core convection and resulting dynamo action in rotating A-type stars

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We present the results of 3–D nonlinear simulations of magnetic dynamo action by core convection within A-type stars of 2 solar masses, at a range of rotation rates. We consider the inner 30% by radius of such stars, with the spherical domain thereby encompassing the convective core and a portion of the surrounding radiative envelope. The compressible Navier-Stokes equations, subject to the anelastic approximation, are solved to examine highly nonlinear flows that span multiple scale heights, exhibit intricate time dependence, and admit magnetic dynamo action. Small initial seed magnetic fields are found to be amplified greatly by the convective and zonal flows. The central columns of strikingly slow rotation found in some of our progenitor hydrodynamic simulations continue to be realized in some simulations to a lesser degree, with such differential rotation arising from the redistribution of angular momentum by the nonlinear convection and magnetic fields. We assess the properties of the magnetic fields thus generated, the extent of convective penetration, the magnitude of the differential rotation, and the excitation of gravity waves within the radiative envelope.