DYNAMO ACTIVITY IN MASSIVE STARS

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Dynamos in solar-like stars rely on convective instability as a source of free energy to amplify seed fields in the stellar envelope. In massive stars, the envelope is convectively stable: this has been widely taken to mean that dynamos do not operate in hot star envelopes. However, a distinct source of free energy is provided in cases where the seed field is itself subject to magnetic instability. One such instability, driven by curvature and gradient forces, was identified by Tayler (1973). Spruit has shown that an astrophysical dynamo can operate in the non-convective material of a differentially rotating star as a result of Tayler's instability. By assuming that the dynamo operates in a state of marginal instability, Spruit has obtained formulae which predict the equilibrium strengths of azimuthal and radial field components in terms of local physical quantities. Applying Spruit's formulae to models of rotating stars with masses of 10 and 50 M(sun), we find that fields inside the envelope can have strengths of a few kilogauss in the radial component, and hundreds of kG in azimuthal components. Buoyancy contributes to raising the internal fields towards the surface of the star in the form of discrete loops. Reconnection between emerging loops is expected to give rise to analogs of solar flares and loop oscillations.