Connecting the large- with the small-scale surface magnetic field of solar-like stars

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Abstract

The origin of the surface magnetic fields of cool stars are still not fully understood especially if they show strong toroidal fields. In order to better understand these observations, we compare the magnetic field topology of observed and simulated cool stars. For ease of comparison between the high-resolution non-potential magnetofrictional simulations and the relatively low-resolution observations, we filter out the small-scale field in the simulations using a spherical harmonics decomposition. We show that the large-scale field topologies of the solar-based simulations produce values of poloidal/toroidal fields and fractions of energy in axisymmetric modes which are similar to the observations. These global non-potential evolution model simulations capture key magnetic features of the observed solar-like stars through the processes of surface flux transport and magnetic flux emergence.

Keywords: surface magnetic fields, simulations, spherical harmonics decomposition, toroidal, poloidal

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