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ABSTRACT

HOW DOES THE INTERNAL STRUCTURE OF YOUNG STARS DETERMINE THEIR MAGNETIC TOPOLOGY?

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The magnetic field plays an important role in the evolution of pre-main sequence stars; it governs the accretion process and influences their angular momentum evolution. It is believed that a dynamo mechanism operating inside the stars generates and sustains the stellar magnetic field. According to the mean-field dynamo theory it depends on the differential rotation and turbulent convection. Both the rotation and the convective motions vary with the age of the star. Unfortunately it is very little what we know about the stellar differential rotation. For the convective motions we rely on the results of stellar structure and evolution models based in the mixing length theory. Recently large-scale profiles of the magnetic fields have been derived for a small sample of Ttauri stars, establishing a connection between the maps of the magnetic fields and the position of the stars in Hertzsprung-Russell diagram. These profiles suggest a dependency between the magnetic topology and the internal structure of the star, more specifically, the size of its convective layer. With this results as our reference, we aim to perform numerical simulations of turbulent rotating convection for stars in different evolutionary stage, i.e., fully convective as well as stars that have developed a radiative core. Our goal is to identify the mechanisms of angular momentum transport (differential rotation) and the main agents of the magnetic field amplification (dynamo) for each case. Because of the possible formation of a tachocline in the later cases, it is expected that different types of dynamo develop in each simulated star. Preliminary results indicate in both cases the existence of solar-like differential rotation (equator rotating faster than the poles). For the fully convective case we observe the development of large scale magnetic field even in the absence of a tachocline. The simulations with a radiative core develop a radial shear layer which is the main responsible for generation of large scale magnetic fields.

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