Abstract for "New branch of the Tayler-Spruit dynamo in 3D numerical simulations of stably stratified stellar regions"

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Asteroseismic measurements provide robust constrains of the stellar interior properties. They especially reveal that current 1D stellar evolution models struggle to reproduce the slow rotation of stellar cores, suggesting that angular momentum transport mechanisms ignored in these models must operate in stellar radiative zones. While strong large-scale magnetic fields are promising candidates to explain the observed rotations, the question of their origin remains an open question. A dynamo mechanism driven by the Tayler instability, the so-called Tayler-Spruit dynamo, has been proposed to form these magnetic fields in very strongly stratified stellar regions. Despite promising analytical results, the subcritical nature of this dynamo has made this mechanism very difficult to capture in 3D MHD numerical simulations. I will present new simulations of stellar radiative zones ran with the MHD code MagIC. They demonstrate the existence of a new branch of the Tayler-Spruit dynamo that is distinct from the one first identified by *Petitdemange et al.* Indeed, the magnetic field harbours a similar polar structure as the Tayler-Spruit dynamo identified in the context of magnetar formation by *Barrère et al.* The dynamo can be maintained for the first time with stratifications relevant for stellar interiors, and the stemming angular momentum transport very efficiently flattens the rotation profile. Beyond helping constrain the physics of the Tayler-Spruit dynamo, these new simulations, therefore, demonstrate its relevance to explain transport in stars. Combined with asteroseismic measurements of rotation and magnetic fields, the future production of evolution models using the prescriptions arising from these simulations will enable the identification of stellar evolution phases in which this dynamo operates.