Including magnetism in an equatorial model for asteroseismology

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In the past years, thanks to the progress in spaceborne high-precision photometry, asteroseismology has made it possible to investigate the core magnetism of red giant stars. However, these analyses were made using a perturbative approach, which breaks down for magnetic fields with large intensity. In this context, it is necessary to develop formalisms that go beyond this approach. One of the possibilities to grasp a better qualitative understanding of the problem at stake is to restrict the geometry to the equatorial plane.

To accomplish this, I incorporated magnetism into a model of oscillations restricted to the equatorial plane. To begin with, I consider the impact of a hypothetical toroidal field on wave oscillations, particularly gravity waves, using the structure profile of a 1 Msun star during the pre-main sequence, the main sequence, and the red giant branch phase. The formalism enables us to explore the imprint that the Lorentz force leaves on the modes, especially in terms of period spacing. I first consider the effect of the magnetic field alone and then discuss the combined effects of magnetism and rotation. This formalism opens the possibility to explore a wider range of configurations, including realistic ones derived from numerical simulations or semi-analytic computations assuming field stability.