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Abstract pour les journées de la SF2A 2025 session 20: Processus de transport dans les étoiles et planètes : contraintes observationnelles et défis théoriques

Wave topology of stellar inertial waves

Inertial waves have been observed and detected in a number of stars and on the surface of the Sun in recent years. In stably stratified regions, they mix with gravity waves to form internal waves, where buoyancy often dominates the radial component of the Coriolis force (the so-called non-traditional component).
In convective regions however, internal waves are purely inertial, and the full Coriolis force must be taken into account, which is the relevant situation for the Sun and the cores of Gamma Dor. I will show that these waves exhibit two properties linked to a topological constraint: they have a Chern number of 1. After presenting this number and its importance in other waves in geophysical and astrophysical contexts, I will show that the first of these two consequences is the existence of a unique, unidirectional, prograde oscillation mode within the cavity, which propagates at arbitrarily low frequencies. The second consequence of the Chern number is the presence of phase singularities in Fourier space, in the phase difference between radial and meridional velocities. Around the singularity, the phase winds with winding numbers depending on the hemisphere. Phase winding is a collective effect over waves propagating in all horizontal directions. I will show the robustness of this winding number to the presence of noise in the data, by using numerical simulations.