Astrophysikalisches Kolloquium
Leibniz-Institut für Sonnenphysik
Freiburg, 3 July 2023, 15h

THE ROLE OF ENTROPY STRATIFICATION IN THE FLUX-STORAGE CAPACITY OF THE TACHOCLINE

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Abstract.

At the interface between the convection zone and the underlying stably stratified radiative interior there is a thin layer of overshooting convection ('overshoot layer') in which the temperature gradient is *subadiabatic*. Below the convection zone there also exists a shear layer known as the 'tachocline', which represents a sharp transition between two distinct rotational regimes: the differentially rotating convection zone and the almost rigidly rotating radiative interior. The relative position between these two boundary layers - one mechanical and one thermal - determines the degree of *subadiabaticity* of the tachocline. Since the decade of 1980 many astrophysicists believe that the tachocline plays a fundamental role in the generation and storage of the toroidal magnetic flux that eventually becomes unstable and buoyantly rises to emerge at the stellar surface producing sunspots.

In this talk I will discuss the role of the thermodynamic properties (and more specifically, the entropy stratification) of the overshoot layer in determining the stability of magnetic structures and, therefore, its capability to store magnetic flux. The entropy stratification is quantified by a dimensionless physical quantity called the *superadiabaticity*, δ. Tiny variations in δ (of the order of 10^{-4} or less) may determine global properties of the magnetic field at the solar surface. The connection between temporal variations in δ (which would alter the storage capacity of the tachocline) with the occurence of Maunder-minimum-like episodes and will be discussed.