# Investigating Tayler Instability in a Liquid Metal Experiment

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The Tayler instability is believed to play a crucial role in a number of astrophysical objects [?], as well as in industrial applications [?]. When an electrically conducting fluid is subjected to a sufficiently strong toroidal magnetic field, this kink-type magnetohydrodynamic (MHD) instability can produce non-axisymmetric flow motions and even turbulence.

This induced turbulence may explain why the cores of many stars rotate more slowly than expected, especially in radiative zones, where heat is transported outwards by radiation rather than convection [?]. It may also influence the efficiency of liquid metal batteries, a very promising technology recently proposed for high-capacity grid energy storage and balancing intermittent renewable energy sources [?].

We present an experimental setup that evidences Tayler instability in the laboratory. It consists of a cylindrical vessel filled with a liquid metal (Gallinstan) into which a high electric current (up to 3000 amperes) is injected axially, generating a toroidal magnetic field. In addition, external coils are used to apply an axial magnetic field (300 G). Measurements using magnetic Hall probes, electric potential velocimetry electrodes and several resistive temperature detectors (RTDs) are performed. By carefully controlling the apparatus temperature, we characterize the bifurcation, geometry and linear growth rate of the unstable mode.

We show how the axial magnetic field modifies the onset of the Tayler instability and the geometry of the unstable modes. Finally, our results are discussed in the context of astrophysical and industrial applications.

## Références

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