

Title: Magnetically Regulated Zonal Winds in Ultra-Hot Jupiters: A Population-Level Constraint on Exoplanetary Magnetic Fields

Author: Julia V. Seidel - Lagrange Laboratory, OCA, Nice and ESO, Santiago, Chile

With Vivien Parmientier, Lagrange, Bibiana Prinoth, University of Lund, Florian Debras, IRAP, S. Albrecht, University of Aarhus

Atmospheric dynamics in ultra-hot Jupiters offer a unique window into the coupling between planetary interiors and their irradiated atmospheres. In this talk, I will present the first population-level survey of zonal wind speeds in these extreme atmospheres, derived from high-resolution transmission spectra using ESPRESSO and MAROON-X.

Focusing on neutral iron as a robust atmospheric tracer, we systematically measure wind-induced Doppler shifts across the known population of ultra-hot Jupiters. The emerging trend reveals a clear temperature dependence of zonal wind speeds, with a marked suppression at higher equilibrium temperatures. When compared to theoretical predictions from heat engine models (e.g., Koll & Komacek 2018), this trend can be explained by magnetic drag.

This study provides the first indirect, population-wide constraint on magnetic field strengths in ultra-hot Jupiters beyond star-planet interactions. It underscores the crucial role of magnetic interactions in shaping atmospheric dynamics and opens a new avenue for connecting observable wind patterns to the deep internal properties of exoplanets.