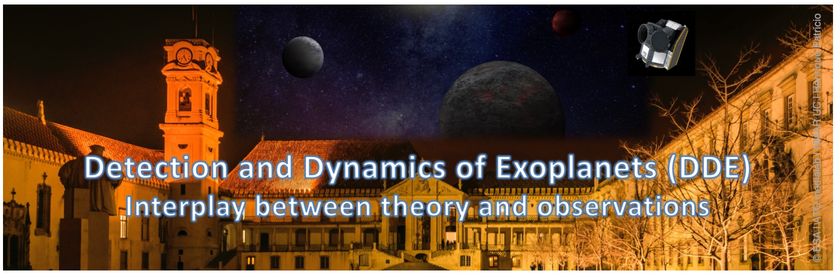

Contribution ID: **24** Type: **not specified**

From Tides to Currents: Unraveling the Mechanism That Powers WASP-107b's Internal Heat Flux

Thursday 10 July 2025 14:45 (15 minutes)

The sub-Jovian exoplanet WASP-107b ranks among the best-characterized low-density worlds, featuring a Jupiter-like radius and a mass that lies firmly in the sub-Saturn range. Recently obtained JWST spectra reveal significant methane depletion in the atmosphere, indicating that WASP-107b's envelope has both a high metallicity and an elevated internal heat flux. Together with a detected non-zero orbital eccentricity, these data have been interpreted as evidence of tidal heating. However, explaining the observed luminosity with tidal dissipation requires an unusually low tidal quality factor of Q ˜ 100. Moreover, we find that secular excitation by the RV-detected outer companion WASP-107c, generally cannot sustain WASP-107b's eccentricity in steady state against tidal circularization. As an alternative explanation, we propose that Ohmic dissipation —generated by interactions between zonal flows and the planetary magnetic field in a partially ionized atmosphere —more naturally maintains the observed thermal state. Under conservative assumptions for the field strength, atmospheric circulation, and ionization chemistry, we show that Ohmic heating readily accounts for WASP-107b's inflated radius and anomalously large internal entropy. In light of this result, tidal mechanisms need not contribute significantly to WASP-107b's present-day energy budget, reconciling the tension between the system's age and measured eccentricity with a tidal quality factor Q > 10,000.

Presenter: BATYGIN, Konstantin (Caltech)

Session Classification: Star-planet interactions and exoplanets' characterization