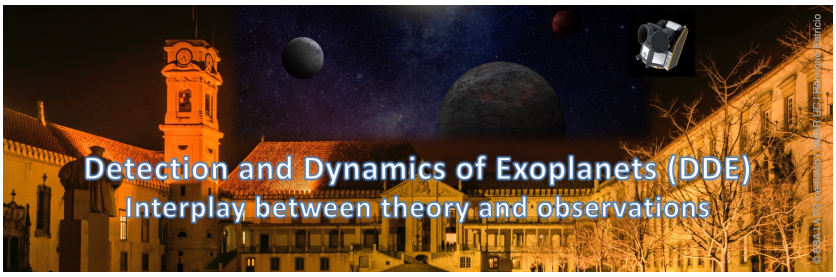

Contribution ID: **22** Type: **not specified**

Advancing JADE: Evolution of hot Sub-Neptunes with Water-Enriched Atmospheres

Thursday, July 10, 2025 4:00 PM (15 minutes)

Exoplanets in the hot Neptune desert, with their proximity to host stars and limited envelope masses, challenge our understanding of planetary evolution. Their survival despite expected significant atmospheric loss raises questions about their origins and the mechanisms shaping their evolution. To address these complexities, JADE (Joining Atmosphere and Dynamics for Exoplanets) was developed to couple secular orbital evolution with atmospheric loss over long timescales. JADE reproduced the misaligned orbit of GJ 436 b, a warm Neptune, revealing the interplay between high-eccentricity migration and delayed atmospheric escape. However, the current version of JADE assumes a pure H/He envelope, which may not fully represent small Neptunes and sub-Neptunes, as these planets likely exhibit higher envelope metallicities and molecular compositions. We now extend JADE by incorporating water into H/He-dominated envelopes, with refinements in opacity, equation of states for density profile, and mass loss rates. I will show how these advancements enable more realistic simulations of close-in planets' atmospheres, exploring how they bloat or shed their envelopes in response to the intricate dance orchestrated by their host stars and outer companions. We aim to expand JADE's applicability to a broader range of exoplanetary systems and welcome collaborations emerging from this conference.

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Session Classification: Star-planet interactions and exoplanets' characterization