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Stability and dynamics of planetary systems

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The remarkable diversity of exoplanetary systems has challenged our understanding of planet formation and evolution. While many systems exhibit orderly, compact architectures, others appear dynamically excited or even sculpted by past instabilities. Interpreting this diversity requires connecting theoretical models of system evolution with emerging observational constraints.

In the first part of this talk, I will explore how short-period multi-planet systems can evolve through dynamical instabilities, transitioning from compact, often resonant "peas-in-a-pod"configurations to more widely spaced and diverse orbital architectures. I will highlight recent efforts to assess the stability of these systems and to model their evolution following instability, with a focus on how these processes relate to observed trends in orbital spacing and planet sizes.

In the second part, I will turn to the role of orbital inclinations as tracers of dynamical histories. While eccentricities have long provided clues into the evolution of gas giants, inclinations—measured through stellar obliquities and mutual inclinations via astrometry—are now revealing new and sometimes surprising patterns. These include hot Neptunes on nearly polar orbits and eccentric warm Jupiters that remain strikingly spin-orbit aligned. I will discuss how such findings inform our understanding of disk-planet interactions and the long-term tidal evolution of exoplanetary systems.

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