ASTROPHYSICS SEMINAR SERIES

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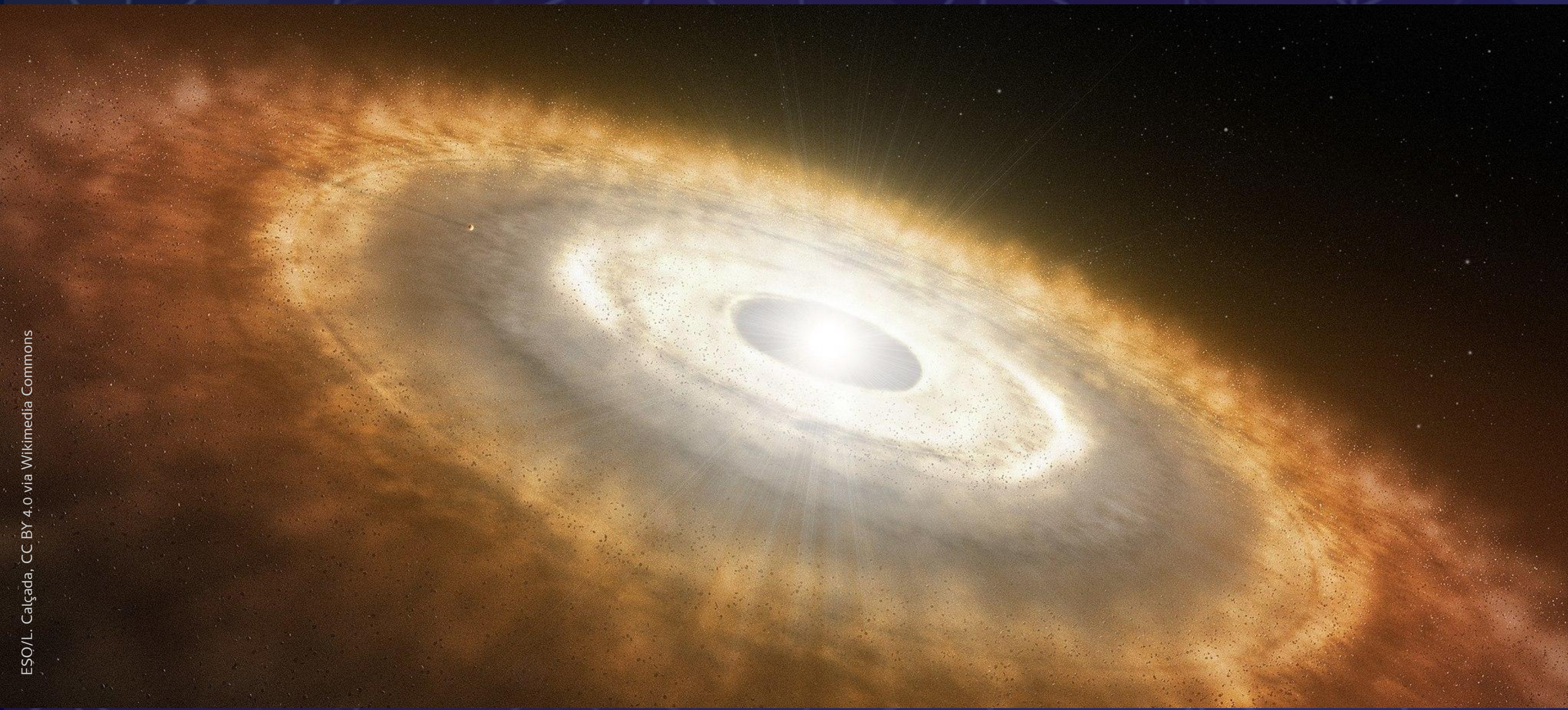

Protoplanetary Disks and Clouds in Substellar Atmospheres: Insights from Microphysics

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In this talk, I will provide evidence that protoplanetary disks are more than an order of magnitude more massive than previously appreciated, that the detailed properties of clouds shape observations of substellar atmospheres, and that the physics of modeling clouds gives a new understanding of the solid content in protoplanetary disks. Clouds on extrasolar worlds are seemingly abundant and interfere with observations; however, little is known about their properties. In our modeling, we predict cloud properties from first principles and investigate how the interesting observational properties of hot Jupiters and brown dwarfs can be explained by clouds. Next, I will report on a new set of models that reconcile theory with observations of protoplanetary disks and create a new set of initial conditions for planet formation models. The total mass available in protoplanetary disks is a critical initial condition for understanding planet formation, however, the surface densities of protoplanetary disks still remain largely unconstrained due to uncertainties in the dust-to-gas ratio and CO abundance. I make use of recent resolved multiwavelength observations of disks in the millimeter to constrain the aerodynamic properties of dust grains to infer the total disk mass without an assumed dust opacity or tracer-to-H_2 ratio. Finally, I will present new work that combines the microphysics of cloud formation in planetary atmospheres and our new models of protoplanetary disks to show that the observed depletion of CO in well-studied disks is consistent with freeze-out processes and that the variable CO depletion observed in disks can be explained by the processes of freeze-out and particle drift.

16 FEB 2021 **3:30 PM EST** **YouTube LIVE**