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Accretion Variability and Binarity in Young Stars: Insights from DQ Tau and Transition Disks

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Accreting binary systems interact with their circumstellar and circumbinary environments, leading to variability across multiple wavelengths and timescales. Understanding these variations is essential for constraining accretion physics and disk structures. With its nearly pole-on orientation, DQ Tau allows a detailed investigation of accretion variability across different wavelengths. DQ Tau is a highly eccentric (e = 0.6), equal-mass binary that exhibits sharp accretion events at periastron passage. The short-period nature of the system (15.7 days) enables orbital motion to clear the central region around the binary, leading to the formation of up to three accretion disks. The circumbinary accretion streams are strongly influenced by the system's orbital parameters. Using VLT/UVES and VLT/X-Shooter, we have applied the broadening function (BF) technique to calculate radial velocities (RVs) across multiple epochs. The BF analysis confirms the presence of two RV signatures corresponding to the equal-mass components, as previously reported in the literature. Over multiple epochs, we observe variations in the BF peaks of both components, including changes in height (flux ratio), which depend on their orbital positions. Additionally, these variations provide insights into the veiling effect on both components. In this talk, I will demonstrate the results of the spectral disentangling carried on DQ Tau, deriving the accretion rates of both stars. I will also show the influence of the pulsed accretion on the measured RVs across 10 orbits provided by a recent simultaneous JWST, LCO, and XShooter campaign and that of UVES. The study of DQ Tau has influenced our understanding of young binary systems. More specifically, how much further can we push the study of binarity in variable accretors? In the second part of the talk, I will highlight disks with big dust-free cavities shown by ALMA continuum images, and often where the inner disk is casting shadows on the outer disk, proposing that they are carved by a sub/stellar companion. I will tackle the observed RV variations with ESPRESSO/VLT for a sample of 12 transition disks (e.g., RY Lup), with 2 clear RV signatures, across 3 years and the possible binary configurations that might explain the cavities seen by ALMA. Finally, I will point out how to disentangle the variations caused by stellar activity.

Presenter: Ms ALQUBELAT, Hala (European Southern Observatory)

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