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Probing Axion-like Dark Matter via Time-Variable Polarization in Protoplanetary Disks

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Among the various dark matter candidates, axion-like dark matter—particularly in the ultralight regime around 10^−22 eV—has attracted significant attention in recent years, as it has been proposed as a potential solution to the small-scale structure problems in the standard cosmological model.
In this talk, we present a new observational constraint on ALP dark matter based on archival data from the Very Large Telescope (VLT). Specifically, we analyze time-series polarimetric data of HD 163296 and place limits on the coupling between ALP dark matter and photons. Furthermore, we show that if the uncertainty in the polarization angle can be reduced to 0.1° and high-cadence monitoring is achieved, the existing upper bounds can be significantly improved. This demonstrates the potential of time-domain polarimetry of nearby young stellar objects as a novel probe of ultralight dark matter.

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