Contribution ID: **830** Type: **Talk in the parallel session**

Time-delay cosmography in the age of JWST

Monday 5 July 2021 16:55 (20 minutes)

Our cosmological discourse is currently dominated by the discrepancy between early and late-time cosmological probes. This tension, if confirmed, can only be resolved by yet unknown physics or by our lack of accounting for systematic uncertainties in the methods. Given the drastic implications of the former, the latter has been of great interest lately. In the context of time-delay strong lensing (TDSL), which has been established as one of the few powerful and independent probes of H0, the prominent mass-sheet degeneracy (MSD) is commonly cited as being a significant source of systematics. This degeneracy is tightly linked to our lack of understanding of the inner mass density profiles of galaxies and introduces a full degeneracy with H0 in the models. Additional tracers of the underlying gravitational potential are needed to break the degeneracy. Yet, current observational facilities fall short in obtaining the required data. In my talk, I will show how JWST will help us to finally break the MSD, by tightly constraining the amount of mass-sheet that is physically associated with the lens. Based on detailed simulations with JWST-like stellar kinematics, we find that uncertainties of the time-delay distance and the lens angular diameter distance can be limited to better than 10%, without assumptions on the background cosmological model. These distance constraints would translate to a < 4% precision measurement on H0 in flat LCDM cosmology from a single lens. Based on these forecasts, TDSL will regain much of its precision while still allowing for models which are maximally degenerate with H0. This will enable us to obtain a < 2% precision measurement on H0 by means of only a few lens systems and potentially provide a smoking gun evidence to address the H0 tension within JWST's first few years of operation.

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Session Classification: Cosmography with Gravitational Lensing

Track Classification: Dark Energy and Large Scale Structure: Cosmography with Gravitational Lensing