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Time-delay cosmography as an independent and competitive cosmological probe

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The percent precision achieved on the values of the cosmological parameters defining the expansion rate and the geometry of the Universe has recently revealed some tension between the measurements of the value of the Hubble constant (H0) from local and early-Universe cosmological probes. The best strategy forward today is to develop independent and complementary techniques to measure H0, and assess a tension that signals new physics beyond the standard cosmological model.

Using time delays of time-varying sources, such as supernovae (SNe) or quasars, that are strongly lensed by galaxy clusters grants such an opportunity. Known as time-delay cosmography, this single-step method is fully independent from other probes, and as such, can play a crucial role in helping to clarify the current Hubble tension problem.

In this talk, I will review recent developments and current efforts in time-delay cosmography with galaxy- and cluster-scale systems. Remarkably, the relative error on the inferred value of H0 from a single (galaxy or cluster) strong lensing system is similar and demonstrates the complementarity of the two techniques. I will finally highlight novel ideas aimed at enhancing the power of time delays in lens clusters by probing the member galaxies. Such studies are paving the way for using a statistically significant sample of these rare lensing configurations, that will be discovered in forthcoming surveys, like the LSST and Euclid, as a competitive cosmological probe.

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