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Cosmic chronometers and time delay cosmography: a new synergy to constrain the expansion history of the Universe

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In the era of precision cosmology, where the accuracy of observational probes and the rigorous control of systematic uncertainties are of paramount importance, exploring the synergies among different methods can play a key role. Typically this is done on a global level and the results from different probes, coming from various datasets, are combined to increase the precision of the cosmological constraint. Here instead we report the first attempt for a self-consistent probe combination, where different methods are applied on the same sample.

In particular, we want to exploit the synergy of two complementary approaches - time delay cosmography (TDC) and cosmic chronometers (CC) - whose combination can boost their precision in constraining cosmological parameters and their robustness against systematic effects. Given a lens galaxy cluster, TDC allows estimates of H_0 based on time delays between the multiple images of time-varying sources strongly lensed by the cluster; at the same time, CC can constrain the differential time evolution of the Universe as traced by the most massive and passive galaxies, members of the same lens cluster and other lens clusters in close-by redshift bins.

In particular, I will show the preliminary results of an ongoing pilot project, focusing on the galaxy cluster MACS J1149.5+2223 (z=0.54), for which TDC has already produced constraints on H_0 thanks to the presence of the multiply imaged SN 'Resfdal'. Here, instead, we want to apply the CC method benefiting from the exquisite quality of VLT/MUSE spectra available for its member galaxies and for those of its redshift-neighbours SDSS J1029+2623 (z=0.59) and SDSS J2222+2745 (z=0.49). Finally, the combination of their results will allow us to test the power of this joint analysis.

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