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Toward an independent reconstruction of the expansion history of the Universe

Friday, 30 September 2022 12:20 (20 minutes)

A cosmological-model independent reconstruction of the expansion history of the Universe can help to shed light on the dark sector and the current cosmological tensions. I will discuss past, present, and future efforts to constrain the Hubble parameter $H(z)$ using two optimal astrophysical probes: cosmic chronometers and gravitational waves. Massive and passive galaxies can be used as chronometers to obtain direct measurements of the Hubble parameter without any cosmological model assumptions, $H(z) = -1/(1+z)\,\mathrm{d}z/\mathrm{d}t$. However, robust $\mathrm{d}t$ estimates require deep spectroscopy to break internal degeneracies between stellar population parameters (e.g., age and chemical content). I present a recent analysis of the stellar ages, [Z/H], and $[\alpha/\mathrm{Fe}]$ of 140 cosmic chronometers at $z \sim 0.7$ from the LEGA-C survey using an optimized set of Lick indices (arXiv:2106.14894). From the age-z relation of this population, a new measurement of $H(z)$ is derived, assessing in detail its robustness and dependence on systematic effects (arXiv:2110.04304). Finally, I will present the synergies betheen cosmic chronometers and gravitational wave cosmology in the context of current and future galaxy surveys and detectors.

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