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Varying fundamental constants and dark energy in the ESPRESSO era

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The observational evidence for the recent acceleration of the universe shows that canonical theories of cosmology and particle physics are incomplete and that new physics is out there, waiting to be discovered. A compelling task for astrophysical facilities is to search for, identify and ultimately characterize this new physics. I will present very recent developments in tests of the stability of nature's fundamental constants, as well as their impact on physics paradigms beyond the standard model. Specifically I will discuss new observational constraints at low redshifts and at the BBN epoch, and highlight their different implications for canonical quintessence-type models and for non-canonical string-theory inspired models. Finally I will also present new forecasts, based on realistic simulated data, of the gains in sensitivity for these constraints expected from ELT-HIRES, on its own and in combination with Euclid.

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