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Astrophysical Tests of the Nature of Dark Matter, the Expansion of the Universe, and Evolving Physical Constants

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Progress made over the past decade in high precision astronomical spectroscopy has been principally motivated by the rapid growth in the study of exoplanets. However, these, and envisioned, gains can also be applied to new avenues of research that could have profound implications on our understanding of basic physics. I will begin by reviewing the current status of astronomical investigations of claimed variations in fundamental physical constants, describe where technical developments are heading, and close by describing tests of gravity/dark matter and the basic model of cosmological expansion that might occur over the next decade or two.