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Fundamental physics from observations of white dwarf stars.

Variation in fundamental constants provide an important test of theories of grand unification. Potentially, white dwarf spectra allow us to directly observe variation in fundamental constants at locations of high gravitational potential. We study hot, metal polluted white dwarf stars, combining far-UV spectroscopic observations, atomic physics, atmospheric modelling and fundamental physics, in the search for variation in the fine structure constant. This registers as small, but measurable shifts in the observed wavelengths of highly ionized Fe and Ni lines when compared to laboratory wavelengths. Measurements of these shifts were performed by Berengut et al. (2013) using high-resolution STIS spectra of G191-B2B, demonstrating the validity of the method. We have extended this work by; (a) using new (high precision) laboratory wavelengths, (b) refining the analysis methodology (incorporating robust techniques from previous studies towards quasars), and (c) enlarging the sample of white dwarf spectra. A successful detection would be the first direct measurement of a gravitational field effect on a bare constant of nature. We have recently been awarded 12 orbits of Cycle 24 HST time to observe hot DA white dwarf stars with a variety of masses, allowing a fully exploration of the compactness parameter space (M/R). This poster will focus on our methods and preliminary results in the search for variations in the fine structure constant at high gravitational potential, from the study of white dwarf spectra.

Summary

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