Towards a hydrogen optical clock

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Since 2019 the SI base units have been defined in terms of physical constants such as the vacuum speed of light, c, or the Planck constant, h. Unique among the SI base units is the second, defined by the value of the unperturbed ground-state hyperfine transition frequency of the ^{133}Cs atom. This frequency can be calculated using perturbation theory, and as such, its value has limited accuracy and can not be expressed using physical constants. The frequency of the 1S-2S transition in atomic hydrogen can be calculated from first principles. An optical lattice clock, based on the 1S-2S transition in hydrogen, would be used to redefine the SI second in terms of fundamental constants and give a "computable second".

Trapping hydrogen at the magic wavelength would also improve the measurement of the 1S-2S transition. This would allow for reduced power in the probe laser beam and reduced systematic uncertainties such as the quadratic ac Stark shift, as well as allow longer integration time.

In this talk, the progress made towards trapping atomic hydrogen in an optical trap will be reviewed.