Contribution ID: **48** Type: **Poster**

Trapped ^{171}Yb^{+} ion for optical frequency metrology

By exploiting narrow optical transitions in trapped atoms, optical clocks have surpassed the frequency stability and accuracy of caesium microwave clocks, the current standard for the SI second, by up to two orders of magnitude [1]. With more progress on the horizon, it is anticipated that the SI second will soon be redefined in terms of an optical frequency standard [2].

For frequency metrology it is important to minimise systematic shifts of the transition frequency caused by external perturbations and to characterise their magnitude. In order to gain confidence in the performance of a clock, international measurement campaigns are regularly carried out to compare the frequencies of distant clocks through optical fibre links, verifying that they agree to within their measured uncertainties.

At the National Physical Laboratory (UK), we use a single ytterbium ion confined in an RF Paul end-cap trap [3] as an atomic frequency reference. This poster will present the advantages of using ^{171}Yb^{+} and the properties that make it an ideal candidate for a precise frequency standard. Moreover, it will expand on the different types of systematic frequency shifts that need to be accounted for and their evaluation, leading to a total fractional uncertainty in the 10^{-18} range.

References:
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Primary author: Ms TOFFUL, Alexandra (National Physical Laboratory UK)

Co-authors: Dr BAYNHAM, Charles F. A. (National Physical Laboratory UK); Dr ROBERTSON, Billy I. (National Physical Laboratory UK); Dr CURTIS, E. Anne (National Physical Laboratory UK); GODUN, Rachel M. (National Physical Laboratory UK); THOMPSON, Richard C. (Imperial College London); GILL, Patrick (National Physical Laboratory UK)

Presenter: Ms TOFFUL, Alexandra (National Physical Laboratory UK)

Session Classification: Poster Session

Track Classification: Atomic Clocks