MEP 2005

CALCIUM ($\lambda \approx 657$ nm)

Absorbing atom ^{40}Ca, $^1S_0 - {}^3P_1$; $\Delta m_J = 0$ transition

1. CIPM recommended values

The values f = 455 986 240 494 140 Hz
λ = 657 459 439.291 683 fm
with a relative standard uncertainty of 1.8×10^{-14} apply to the radiation of a laser stabilized to Ca atoms. The values correspond to the mean frequency of the two recoil-split components for atoms which are effectively stationary, i.e. the values are corrected for the second-order Doppler shift.

2. Source data

Adopted value :	f = 455 986 240 494 140 (8) Hz	$u_c/y = 1.8 \times 10^{-14}$
	for which:	
	λ = 657 459 439.291 683 (12) fm	$u_c/y = 1.8 \times 10^{-14}$

calculated from

f / Hz	u_c/y	source data
455 986 240 494 144	1.2×10^{-14}	[1]
455 986 240 494 135.8	7.5×10^{-15}	[2, 3]
Unweighted mean:	f = 455 986 240 494 140 Hz	

The CCL decided to adopt the unweighted mean of the two values, with an uncertainty of 8 Hz, equal to the difference between the values.

3. References

[1] Degenhardt C., Stoehr H., Lisdat Ch., Wilpers G., Schnatz H., Lipphardt B., Nazarova T., Pottie P.-E., Sterr U., Helmcke J., Riehle F., Calcium Optical Frequency Standard with Ultracold Atoms: Approaching 10^{-15} Relative Uncertainty, *Phys. Rev. A*, **72**, 062111/1-17, 2005.

[2] Wilpers G., Oates C. W., Hollberg L., Improved Uncertainty Budget for Optical Frequency Measurements with Microkelvin Neutral Atoms: Results for a High-Stability ^{40}Ca Optical Frequency Standard, *Appl. Phys. B* **85**, pp. 31-44, 2006.

[3] Wilpers G., Oates C. W., Diddams S. A., Bartels A., Fortier T M., Oskay W. H., Bergquist J. C., Jefferts S. R., Heavner T. P., Parker T. E., Hollberg L., Absolute Frequency Measurement of the Neutral ^{40}Ca Optical Frequency Standard at 657 nm based on Microkelvin Atoms, *Metrologia*, **44**, pp. 146-151, 2007.