

Appendix 4

RECOMMENDATION ADOPTED BY THE INTERNATIONAL COMMITTEE FOR WEIGHTS AND MEASURES

RECOMMENDATION 1 (CI-2013): Updates to the list of standard frequencies

The International Committee for Weights and Measures (CIPM),

considering that

- a common list of “Recommended values of standard frequencies for applications including the practical realization of the metre and secondary representations of the second” has been established,
- the CCL-CCTF Frequency Standards Working Group (FSWG) has reviewed several candidates for inclusion into the list,

recommends the following changes to the list of “Recommended values of standard frequencies for applications including the practical realization of the metre and secondary representations of the second”:

- that the following transition frequency be added to the list:
 - the unperturbed optical transition $6s^2\ ^1S_0 - 6s\ 6p\ ^3P_0$ of the ^{199}Hg neutral atom with a frequency of 1 128 575 290 808 162 Hz and an estimated relative standard uncertainty of 1.7×10^{-14} ;
- that the following transition frequencies be updated in the list:
 - the unperturbed optical transition $4s\ ^2S_{1/2} - 3d\ ^2D_{5/2}$ of the $^{40}\text{Ca}^+$ ion with a frequency of 411 042 129 776 395 Hz and an estimated relative standard uncertainty of 1.5×10^{-14} ;
 - the unperturbed optical transition $1S - 2S$ of the ^1H neutral atom with a frequency of 1 233 030 706 593 518 Hz and an estimated relative standard uncertainty of 1.2×10^{-14} ;

Note: This frequency corresponds to half of the energy difference between the 1S and 2S states;

- that the following transition frequencies be updated in the list and endorsed as secondary representations of the second:
 - the unperturbed optical transition $6s\ ^2S_{1/2} - 4f\ ^{13}6s^2\ ^2F_{7/2}$ of the $^{171}\text{Yb}^+$ ion (octupole) with a frequency of 642 121 496 772 645.6 Hz and an estimated relative standard uncertainty of 1.3×10^{-15} ;
 - the unperturbed optical transition $6s^2\ ^1S_0 - 6s\ 6p\ ^3P_0$ of the ^{171}Yb neutral atom with a frequency of 518 295 836 590 865.0 Hz and an estimated relative standard uncertainty of 2.7×10^{-15} ;

- that the following transition frequency be added to the list and as a secondary representation of the second:
 - the unperturbed optical transition $3s^2\ ^1S_0 - 3s\ 3p\ ^3P_0$ of the $^{27}\text{Al}^+$ ion with a frequency of 1 121 015 393 207 857.3 Hz and an estimated relative standard uncertainty of 1.9×10^{-15} ;
- that the following transition frequencies be updated in the list and as secondary representations of the second:
 - the unperturbed optical transition $5d\ ^{10}6s\ ^2S_{1/2} - 5d\ ^96s^2\ ^2D_{5/2}$ of the $^{199}\text{Hg}^+$ ion with a frequency of 1 064 721 609 899 145.3 Hz and an estimated relative standard uncertainty of 1.9×10^{-15} ;
 - the unperturbed optical transition $6s\ ^2S_{1/2}(F=0, m_F=0) - 5d\ ^2D_{3/2}(F=2, m_F=0)$ of the $^{171}\text{Yb}^+$ ion (quadrupole) with a frequency of 688 358 979 309 307.1 Hz and an estimated relative standard uncertainty of 3×10^{-15} ;
 - the unperturbed optical transition $5s\ ^2S_{1/2} - 4d\ ^2D_{5/2}$ of the $^{88}\text{Sr}^+$ ion with a frequency of 444 779 044 095 485.3 Hz and an estimated relative standard uncertainty of 4.0×10^{-15} ;
 - the unperturbed optical transition $5s^2\ ^1S_0 - 5s5p\ ^3P_0$ of the ^{87}Sr neutral atom with a frequency of 429 228 004 229 873.4 Hz and an estimated relative standard uncertainty of 1×10^{-15} ;
- that the following transition frequency be updated as a secondary representation of the second:
 - the unperturbed ground - state hyperfine transition of ^{87}Rb with a frequency of 6 834 682 610.904 312 Hz and an estimated relative standard uncertainty of 1.3×10^{-15} .

Note: The value of the estimated standard uncertainty is assumed to correspond to a confidence level of 68 %. However, given the very limited number of available data there is a possibility that in hindsight this might not prove to be exact.