

**RECOMMENDATIONS ADOPTED BY THE  
INTERNATIONAL COMMITTEE FOR WEIGHTS AND MEASURES**

**RECOMMENDATION 1 (CI-2006):**

**Concerning secondary representations of the second**

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” shall be established,
- the CCL/CCTF Joint Working Group (JWG) on the *Mise en Pratique* of the Definition of the Metre and the Secondary Representations of the Second in its meeting at the International Bureau of Weights and Measures (BIPM) in September 2005 discussed possible candidates to be included in this list for secondary representations of the second,
- the CCL/CCTF JWG reviewed and updated the values for the Hg ion, Sr ion, Yb ion, and the Sr neutral atom transition frequencies in its session in September 2006,
- the CCTF in its Recommendation CCTF 1 (2004) already recommended the unperturbed ground-state hyperfine quantum transition frequency of  $^{87}\text{Rb}$  as a secondary representation of the second;

**recommends** that the following transition frequencies shall be used as secondary representations of the second and be included into the new list of “Recommended values of standard frequencies for applications including the practical realization of the metre and secondary representations of the second”

- the unperturbed ground-state hyperfine quantum transition of  $^{87}\text{Rb}$  with a frequency of  $f_{^{87}\text{Rb}} = 6\,834\,682\,610.904\,324$  Hz and an estimated relative standard uncertainty of  $3 \times 10^{-15}$ ,

- the unperturbed optical  $5s\ ^2S_{1/2} - 4d\ ^2D_{5/2}$  transition of the  $^{88}\text{Sr}^+$  ion with a frequency of  $f_{^{88}\text{Sr}^+} = 444\ 779\ 044\ 095\ 484$  Hz and a relative uncertainty of  $7 \times 10^{-15}$ ,
- the unperturbed optical  $5d^{10}\ 6s\ ^2S_{1/2} (F = 0) - 5d^9\ 6s^2\ ^2D_{5/2} (F = 2)$  transition of the  $^{199}\text{Hg}^+$  ion with a frequency of  $f_{^{199}\text{Hg}^+} = 1\ 064\ 721\ 609\ 899\ 145$  Hz and a relative standard uncertainty of  $3 \times 10^{-15}$ ,
- the unperturbed optical  $6s\ ^2S_{1/2} (F = 0) - 5d\ ^2D_{3/2} (F = 2)$  transition of the  $^{171}\text{Yb}^+$  ion with a frequency of  $f_{^{171}\text{Yb}^+} = 688\ 358\ 979\ 309\ 308$  Hz and a relative standard uncertainty of  $9 \times 10^{-15}$ ,
- the unperturbed optical transition  $5s^2\ ^1S_0 - 5s\ 5p\ ^3P_0$  of the  $^{87}\text{Sr}$  neutral atom with a frequency of  $f_{^{87}\text{Sr}} = 429\ 228\ 004\ 229\ 877$  Hz and a relative standard uncertainty of  $1.5 \times 10^{-14}$ .