

MEP 2003

Spectral lamp radiations

⁸⁶Kr, ¹⁹⁸Hg, ¹¹⁴Cd, spectral lamp radiations

1 CIPM recommended values

Vacuum wavelengths, λ , for ⁸⁶Kr, ¹⁹⁸Hg and ¹¹⁴Cd transitions

Atom	Transition	λ / pm
⁸⁶ Kr	2p ₉ – 5d' ₄	645 807.20
⁸⁶ Kr	2p ₈ – 5d ₄	642 280.06
⁸⁶ Kr	1s ₃ – 3p ₁₀	565 112.86
⁸⁶ Kr	1s ₄ – 3p ₈	450 361.62
¹⁹⁸ Hg	6 ¹ P ₁ – 6 ¹ D ₂	579 226.83
¹⁹⁸ Hg	6 ¹ P ₁ – 6 ³ D ₂	577 119.83
¹⁹⁸ Hg	6 ³ P ₂ – 7 ³ S ₁	546 227.05
¹⁹⁸ Hg	6 ³ P ₁ – 7 ³ S ₁	435 956.24
¹¹⁴ Cd	5 ¹ P ₁ – 5 ¹ D ₂	644 024.80
¹¹⁴ Cd	5 ³ P ₂ – 6 ³ S ₁	508 723.79
¹¹⁴ Cd	5 ³ P ₁ – 6 ³ S ₁	480 125.21
¹¹⁴ Cd	5 ³ P ₀ – 6 ³ S ₁	467 945.81

For ⁸⁶Kr, the above values with a relative expanded uncertainty $U = 2 \times 10^{-8}$, where $U = ku_c$ ($k = 3$), apply to radiations emitted by a hot-cathode discharge lamp containing ⁸⁶Kr, of a purity not less than 99 %, in sufficient quantity to assure the presence of solid krypton at a temperature of 64 K, this lamp having a capillary with an inner diameter from 2 mm to 4 mm and a wall thickness of about 1 mm.

It is estimated that the wavelength of the radiation emitted by the positive column is equal, to within 1 part in 10^8 , to the wavelength corresponding to the transition between the unperturbed levels, when the following conditions are satisfied:

- the capillary is observed end-on from the side closest to the anode;
- the lower part of the lamp, including the capillary, is immersed in a cold bath maintained at a temperature within one degree of the triple point of nitrogen;
- the current density in the capillary is $(0.3 \pm 0.1) \text{ A} \cdot \text{cm}^{-2}$.

For ¹⁹⁸Hg, the above values with a relative expanded uncertainty $U = 5 \times 10^{-8}$, where $U = ku_c$ ($k = 3$), apply to radiations emitted by a discharge lamp when the following conditions are met:

- the radiations are produced using a discharge lamp without electrodes containing ¹⁹⁸Hg, of a purity not less than 98 %, and argon at a pressure from 0.5 mm Hg to 1.0 mm Hg (66 Pa to 133 Pa);
- the internal diameter of the capillary of the lamp is about 5 mm, and the radiation is observed transversely;
- the lamp is excited by a high-frequency field at a moderate power and is maintained at a temperature less than 10 °C;
- it is preferred that the volume of the lamp be greater than 20 cm³.

For ¹¹⁴Cd, the above values with a relative expanded uncertainty $U = 7 \times 10^{-8}$, where $U = ku_c$ ($k = 3$), apply to radiations emitted by a discharge lamp under the following conditions:

- the radiations are generated using a discharge lamp without electrodes, containing ^{114}Cd of a purity not less than 95 %, and argon at a pressure of about 1 mm Hg (133 Pa) at ambient temperature;
- the internal diameter of the capillary of the lamp is about 5 mm, and the radiation is observed transversely;
- the lamp is excited by a high-frequency field at a moderate power and is maintained at a temperature such that the green line is not reversed.

2. Source data

The recommended wavelengths are those recommended by the CIPM in 1963 [1, 2].

3. References

[1] *BIPM, Com. Cons. Déf. Mètre*, 1962, **3**, 18-19

[2] *BIPM, Proc. Verb. Com. Int. Poids et Mesures*, 1963, **31**, 26-27.