

Activities of NMIJ, AIST towards the Redefinition of the SI Second

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After more than 100 years, the international prototype on kilogram (IPK) retired as the definition of the kilogram. At the same time, the definitions of ampere (electric current), kelvin (thermodynamic temperature), mole (amount of substance) were also changed. The remaining SI unit waiting for the redefinition is the second (unit of time). In this paper, recent activities of the Time Standards group at NMIJ, AIST towards the redefinition of the SI second will be presented. The first topic is the development of the robust ytterbium (Yb) optical lattice clock for the future optical time scale. Newly developed compact laser systems, compact vacuum systems, and the calm environment enabled a long-time regularly operation, which also led to an unprecedented level of uncertainty evaluation for the second order Zeeman effect [1]. The second topic is the development of the Yb/Sr dual optical lattice clock. Both atomic species are contained in a single vacuum chamber, leading to a partial compensation of the environmental perturbation due to the room-temperature blackbody radiation. This system can be used to investigate the ultracold Yb-Sr interaction [2]. The final topic is the development of the laser-controlled cold Yb atomic beam source for the transportable optical lattice clock. We demonstrated the cold emission of Yb atomic vapors from ytterbium oxide (Yb₂O₃) irradiated with a simple ultraviolet diode laser. Slow atoms are trapped by a magneto-optical trap using a dipole-allowed transition at 399 nm [3].

References

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