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A history of R&D on the optical frequency standards in NICT

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In the field of metrology, we had some technological revolutions. On the frequency standards, the rapid progress of the atomic frequency standards in 1950s and 1960s is a famous case. Introduction of the laser technology made it possible to develop the optically pumped atomic clocks and atomic fountain clocks in 1980s and 1990s. Recent one is the development of the optical atomic clocks since late 1990s. The accuracy of the optical atomic clocks is very sharply increased. Nowadays, some of the optical atomic clocks are contributing to the accuracy of the International Atomic Time (TAI), and the redefinition of the second based on the optical atomic clocks has been seriously discussed.

As a case study, it might be interesting to see the decision to start the research and the process of the development at an institute in such a revolutionary age. Now, National Institute of Information and Communications Technology (NICT) is one of the leading institutes that operate the optical frequency standard to contribute to the accuracy of TAI [1], though the start of R&D is around 2002, rather late. In this paper, we will show what decision was made in early 2000s when Communications Research Laboratory (CRL, one of the former bodies of NICT) started the research and development on optical frequency standards, and how NICT has grown up to be one of the leading institutes in this field, to develop clock lasers [2], optical frequency combs [3], Ca^+ and In^+ ion optical clocks [4.5], and Sr optical lattice clocks [1, 6].

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