# Trapped-ion based optical clocks

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The idea of using a narrow forbidden optical transition in a single trapped ion as a frequency standard originated with Dehmelt's suggestion of electron shelving, published in 1975. This was first demonstrated experimentally at the University of Washington in 1986 using a single barium ion.

Following these early results, there has been considerable progress in demonstrating the potential of trapped ions as optical frequency standards. Work is underway at a number of laboratories with different ions including $^{27}Al^{+}$, $^{199}Hg^{+}$, $^{171}Yb^{+}$, $^{88}Sr^{+}$, $^{115}In^{+}$ and $^{43}Ca^{+}$. Four optical transitions (three based on optical transitions in ions and one in a neutral atom) are now included in a list of secondary representations of the second. The most stable optical standards now equal or surpass the Cs microwave standard and so there will need to be additions to the list of secondary representations of the second in the near future. The most accurate optical frequency standard to date is based on a 267-nm transition in aluminium, with published comparisons between two clocks at NIST at the 7 parts in $10^{18}$ level.

In this talk, I will review the current status of optical clocks based on single trapped ions and prospects for future improvements.

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