Optical clocks with single ions

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Abstract: Following Dehmelt’s seminal ideas of using a single trapped ion, laser cooling and the observation of quantum jumps as a spectroscopic signal, optical clocks have now been realized with a systematic uncertainty in the $10^{-18}$ range. Different elements (Yb, Sr, Al) and different types of reference transitions are investigated. Frequency ratios between these clocks can be measured at an uncertainty that is smaller than in the realization of the SI Hertz with caesium clocks, permitting reliable consistency checks of the new clocks and also searches for new physics like violations of Einstein's equivalence principle.