Atomic clocks, Superpositions and Entanglement

Author and Speaker: Patrick Gill, NPL, UK
Speaker email: patrick.gill(at)npl.co.uk

Abstract: Progress in atomic clocks has taken advantage from quantum techniques even from the original caesium clock developments using Ramsey’s technique of separated field interrogations generating state superpositions. The advent of laser cooling of ions and atoms over four decades ago led to many new quantum operations such as quantum jump detection, cooling to motional ground states in traps, microwave fountain clocks and optical clocks based on single trapped ions or neutral atoms held in optical lattice traps. More recent developments include the dual ion quantum logic clock, and the use of entanglement to achieve frequency instabilities below the standard quantum limit or to measure clock systematic frequency shifts. I will briefly address some of these quantum techniques in atomic clock metrology.