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Perfect probe Light-shift elimination in Generalized Hyper-Ramsey quantum clocks

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We present a new generation of quantum clocks absolutely free from ac Stark-shift caused by laser probing fields themselves based on generalized hyper-Ramsey resonances.
Sequences of composite laser pulses with specific selection of phases, frequency detunings and durations are combined to generate a very efficient and robust frequency locking signal with a perfect elimination of the light-shift from off resonant states. Laser phase-step modulations during interactions with electromagnetic fields are applied in order to decouple the unperturbed frequency measurement from the laser's intensity. The frequency lock point is thus protected against laser pulse area fluctuations and errors in potentially applied frequency shift compensations.
Quantum clocks based on weakly allowed or completely forbidden optical transitions in atoms, ions, molecules and nuclei will benefit from these hyper-stable laser frequency stabilization schemes to reach relative accuracies well below the 10^{-18} level.

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