Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Atomic combination clocks. NITZAN AKERMAN, ROEE OZERI, Physics of complex systems, Weizmann institute of science — The stability and accuracy of atomic clocks are limited by the susceptibility of their internal electronic transitions to external fields. So far atomic clocks were realized using a single species of atom or ion. These atomic species and transitions were selected due to their relative low susceptibility to some environmental perturbations while other properties were typically compromised. We propose to utilize an entangled superposition state of multiple atomic species to form a reference clock frequency. This superposition is selected such that the susceptibilities of the respective transitions, in individual species, destructively interfere leading to improved stability and reduced systematic shifts. One example is the optical quadrupole transitions in a $^{40}Ca^{+}$ - $^{174}Yb^{+}$ two-ion crystal. Here the black-body radiation shift is reduced to the level of 10^{-19} fractional uncertainty as well as diminishing the susceptibility to first order Zeeman shift while benefiting from the small inherent second order Zeeman shift as compare to species with hyperfine structure. Our method is general and applicable to other combinations as well. It extends the space of possibilities in the search for better atomic reference and thus advances the field of quantum precision metrology and atomic clocks in particular.

Nitzan Akerman
Physics of complex systems, Weizmann institute of science

Date submitted: 05 Feb 2018 Electronic form version 1.4