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Room-temperature ultra-sensitive mass spectrometer via dynamic decoupling NAN ZHAO, Beijing Computational Science Research Center, ZHANG-QI YIN, The Center for Quantum Information, Institute for Interdisciplinary Information Sciences, Tsinghua University — We propose an ultra-sensitive mass spectrometer based on a coupled quantum-bit-oscillator system. Under dynamical decoupling control of the quantum bit (qubit), the qubit coherence exhibits a comb structure in time domain. The time-comb structure enables high precision measurement of oscillator frequency, which can be used as an ultra-sensitive mass spectrometer. Surprisingly, in ideal case, the sensitivity of the proposed mass spectrometer, which scales with the temperature T as $T^{-1/2}$, has better performance in higher temperature. While taking into account qubit and oscillator decay, we show that the optimal sensitivity is independent on environmental temperature T. With present technology on solid state spin qubit and high-quality optomechanical system, our proposal is feasible to realize an ultra-sensitive mass spectrometer in room temperature.

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