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Direct frequency comb spectroscopy of atomic and molecular systems using an oscillator having randomly varying repetition frequency (f_{rep}) and offset frequency (f_0) BACHANA LOMSADZE, HYOUNGUK JANG, CHARLES FEHRENBACH, BRETT DEPAOLA, Department of Physics, Kansas State University — In recent years, interest in frequency combs has greatly increased for a variety of reasons. Using a frequency comb one can do high precision measurements on a system to determine standards of fundamental quantities: time, frequency, and length. Combs are widely used for precision spectroscopy of quantum systems as well. In the above-mentioned experiments, two characteristic parameters of the frequency comb: f_{rep} and f_0 must be intricately controlled with very high precision. Furthermore, most oscillators do not have the necessary controls, nor are the controls trivial to retro-fit to an existing oscillator. For these reasons, we propose doing high precision spectroscopy without the control over f_{rep} or f_0; rather, these frequencies are allowed to naturally evolve during an experiment. The essential idea behind this new technique is that we measure, but do not control, these frequencies every time any event, for example an excitation, occurs in our atomic or molecular system. Random change of f_{rep} and f_0 gives us the capability to study all transition frequencies in the system of interest, just as a controlled scan of these frequencies would allow us to do.

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