

CSAAPT Fall 2022 Semi-Virtual Meeting



Chesapeake Section of the
American Association of Physics Teachers
Fall 2022 Semi-Virtual Meeting
October 22, 2022 in Falls Church, VA

Contribution ID: 5

Type: **talk (15-minute)**

Directly measuring the harmonic oscillator wavefunction.

Saturday, October 22, 2022 2:30 PM (15 minutes)

It is important to bring 21st century physics into the classroom. A recent experiment by the Regal lab prepared the first three energy eigenstates of a harmonic oscillator and then used time-of-flight spectroscopy to measure the momentum distribution (which can be easily converted into the momentum-space wavefunction). In this talk, I will explain how this experiment works and how you can bring it into your undergraduate classroom. It is suitable for Modern Physics courses or for junior-senior level Quantum classes. It also can be shown to high school classes as a “really cool” result from the second quantum revolution. The measurement is interesting because we measure position to infer momentum using a cycling atomic transition measurement, which does not really fit the von Neuman measurement paradigm. Discussing this material in your class helps with explaining the uncertainty principle, how measurement of single quanta takes place, and dispels the myth that a wavefunction cannot be measured.

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Session Classification: Afternoon Session 1A (Chair: Juliana Butler, Zoom Monitor: Kent Yagi)