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Weak signal detection using quantum interference[1] MEVAN GUNAWARDENA, D.S. ELLIOTT, Purdue University — We demonstrate a powerful technique for detecting weak atomic or molecular transitions that is based on homodyning two atomic transition amplitudes. The scheme is tested on a weak Stark-induced transition in cesium by exciting its ground 6s $^2S_{1/2}$ state to the 8s $^2S_{1/2}$ excited state by a 411 nm laser field. The strong local oscillator signal is a two-photon transition excited by an 822 nm laser field that connects the same ground and exited states. The Stark-induced transition can be regulated by controlling a DC field across a Cs cell. The simultaneous excitation of the two pathways results in a quantum interference that can be controlled by phase modulating either of the driving laser fields. The change in the relative phase between the laser fields results in a change in the relative phase between the transition amplitudes of the two paths. Thus, phase modulating one of the beams gives rise to an amplitude modulation of the net excitation rate. The amplitude of this modulation allows a quantitative measure of the weak transition rate.

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