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Fano-like Resonance due to Interference with Distant Transitions

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Precision spectroscopy of narrow transitions of atoms and molecules has been the subject of numerous studies in recent decades and has been widely applied in sensing,metrology, and frequency references for optical clocks. Narrow optical resonances also provide excellent probes for determining fundamental physics constants, such as the Rydberg constant and the proton-to-electron mass ratio. In these studies, accurate transition centers derived from fitting the measured spectra are demanded, which critically rely on the knowledge of spectral line profiles.
Here, we propose a new mechanism of Fano-like resonance induced by distant discrete levels and experimentally verify it with Doppler-free spectroscopy of vibration-rotational transitions of CO2 . The observed spectrum has an asymmetric profile and its amplitude increases quadratically with the probe laser power. Our results facilitate a broad range of topics based on narrow transitions.

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