

Simple method for obtaining subnatural dip  
in Doppler-free laser spectroscopy

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We describe a simple method for obtaining a narrow dip with subnatural linewidth in Doppler-free laser spectroscopy. The method is based on detecting the absolute magnitude,  $|\text{Re}[\chi_{\text{NL}}(\omega - \omega_0)]|$ , of the dispersive component (real part) of the nonlinear susceptibility induced by the pump beam, and the line shape recorded therefore exhibits a fully resolved double-peak structure in the resonance frequency,  $\omega_0$ . By using polarization-modulation technique and a dual phase lock-in amplifier, we have demonstrated the dip as narrow as 3 MHz in the laser-induced birefringence spectrum of the Na D<sub>1</sub> line (natural linewidth 10 MHz). Possible spectroscopic applications are considered.