

Application Note: Doppler-Free Spectroscopy

A prominent spectroscopic research group has been conducting saturated absorption experiments in methane with an Aculight® Argos™ continuous wave (CW) optical parametric oscillator (OPO). Using a pump-probe arrangement (figure 1), the absorption profile seen by the probe beam is modified from that seen in simple single pass absorption. If the pump beam is of sufficient intensity, a significant fraction of the methane molecules are pumped to an excited state, resulting in reduced absorption at the probe frequency. A saturated absorption dip (or Lamb dip) is observed when the probe beam is scanned through the absorption frequency.

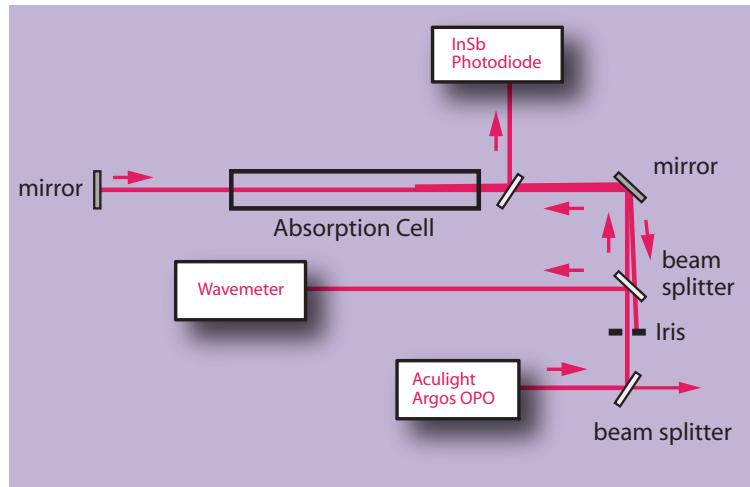


Figure 1: Illustration of saturated absorption measurement technique.

When the pump laser is scanned in this manner the mid-infrared idler frequency scans synchronously through the methane absorption feature. The data in figure 2 were recorded while scanning the OPO idler frequency at 40Hz. This was accomplished by applying a saw-tooth tuning signal to the piezoelectric transducer (PZT) on the seed laser for the Argos' pump source. Cell pressure was 30 μ bar and idler power at the absorption cell entrance was 200 mW.

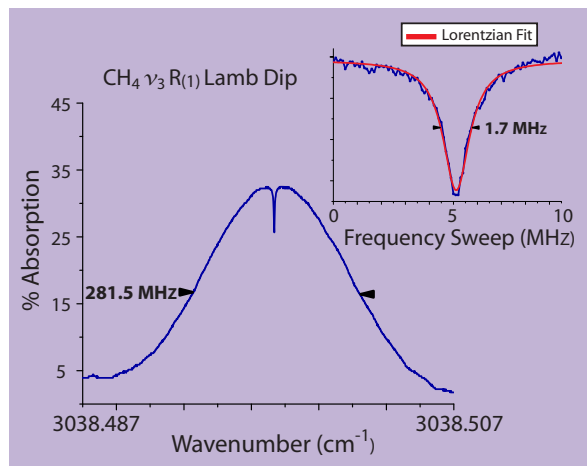


Figure 2: Doppler-free absorption spectrum of methane, showing Lamb dip, measured using Aculight Argos CW OPO.