OPTRA

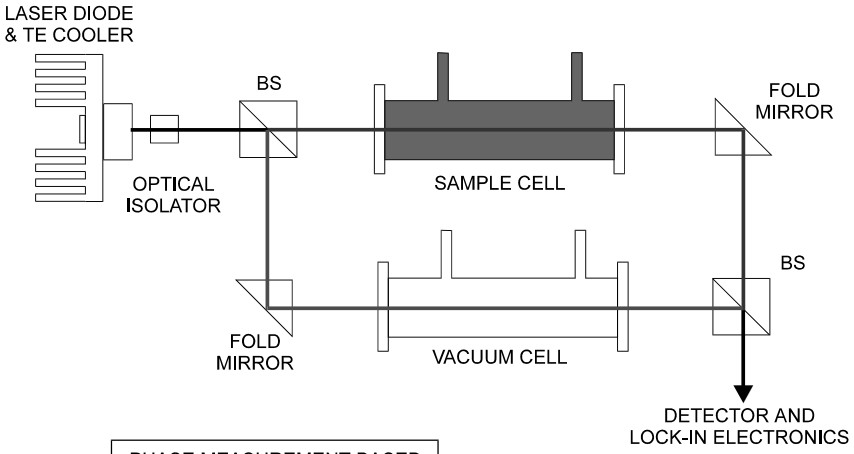
HIGH ALTITUDE WATER VAPOR CONCENTRATION MEASUREMENT USING LASER DIODE INTERFEROMETRY – PHASE I SUMMARY

The purpose of the Phase I research in this program was to establish the feasibility of measuring the concentration of water vapor in the atmosphere by means of the interferometric detection of the anomalous dispersion associated with a water vapor absorption line.

The Phase I results have fully established the feasibility of the interferometric detection of anomalous dispersion signals as a means for monitoring low levels of water vapor concentration. More generally, this appears to be a powerful technique for the spectroscopic monitoring of any absorption lines which can be interrogated by an optical-frequency-modulated tunable laser diode. The Phase I work has also confirmed that stabilization of the laser diode to the water vapor line at 1392 nm can readily be accomplished, using either absorption or anomalous dispersion, in conjunction with a small reference cell containing a moderately high concentration ($\approx 3\times10^{15}$molecules/cm^3) of water vapor at a low enough pressure ($\approx$ 10 torr) to minimize the effects of pressure broadening.

The anomalous dispersion signals were strong, clean, and in agreement with theoretical expectations. We believe we have learned enough about the requirements for the interferometer to design a very robust sensor for use in an unmanned aircraft or, more generally, for field use.

Mach Zehnder Interferometer



PHASE MEASUREMENT BASED
ON ANOMALOUS DISPERSION

Water Vapor Measured Spectra
N = 2.6×10^{15} molecules/cm^3