Laser Spectroscopy is a powerful tool for study of physical, quantum and chemical properties of the matter. Among all laser based spectroscopic techniques laser absorption spectroscopy and its derivatives have become by far the most popular and widely used, mainly due to their high-sensitivity (down to pptv, parts-per-trillion by volume), high-specificity and a relatively simple setup. A coherent nature of laser light in addition to simple absorption measurements allows for optical phase measurements enabling laser spectroscopic techniques suitable for molecular dispersion sensing. Molecular dispersion spectroscopy can provide new capabilities for chemical detection and enable new applications and strategies in environmental monitoring. This paper discusses the current state-of-the art and provides an overview of recently developed chirped laser dispersion spectroscopy (CLaDS) based techniques. CLaDS provides quantitative spectroscopy of trace-gases with extended dynamic range of concentration measurements, and high immunity to photodetected intensity fluctuations. Additionally CLaDS based techniques open new capabilities of processing of spectroscopic signals directly in optical domain. Several examples of CLaDS detection based on quantum cascade lasers (QCLs) will be provided to demonstrate capabilities of molecular dispersion spectroscopy in the mid-infrared spectral region targeting the most intense molecular ro-vibrational bands of various molecular species.