CW SUBMILLIMETER AND TERAHERTZ SPECTROMETERS; TECHNICAL AND PRACTICAL LIMITATIONS

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The design of almost all coherent millimeter and shorter wavelength absorption spectrometers consists of a source, a direct detector and a means of modulating either the source or the molecules followed by lock-in detection. The two figures of merit for any coherent spectroscopic system are 1) the ultimate sensitivity or the smallest change of power that can be detected and 2) the dynamic range or the ratio or smallest detectable change in power to detector saturation power. Advances in electronics and source technology have made radically different spectroscopic systems possible. Two obvious examples include vector network analyzers and near field antenna range measuring systems. Many other examples can be found in various imaging techniques. These systems have been used throughout the submillimeter, THz and well into the optical regime with figures of merit that are often significantly better than traditional millimeter spectrometers. The ultimate sensitivity of microwave absorption spectroscopy is explored in light of alternative microwave system configurations and the fundamental limitations of available components.