above differential equation. Each analyzer type has its strengths and weaknesses. Many mass spectrometers use two or more mass analyzers for MS/MS. There are several important analyzer characteristics. The mass resolving power is the measure of the ability to distinguish two peaks of slightly different *m/z*. The mass accuracy is the ratio of the *m/z* measurement error to the true *m/z*. Mass accuracy is usually measured in ppm or milli mass units. The mass range is the range of *m/z* amenable to analysis by a given analyzer. The linear dynamic range is the range over which an ion signal is linear with the analyte concentration. Speed refers to the time frame of the experiment and is ultimately used to determine the number of spectra per unit time that can be generated.

5.2.2 Spectroscopy

Spectroscopy techniques allow the study of the interaction between matter and electromagnetic radiation. Spectroscopy is used to refer to the measurement of radiation intensity as a function of wavelength and is often used to describe experimental spectroscopic methods. Spectral measurement devices are referred to as spectrometers, spectrophotometers, spectrographs, or spectral analyzers. The central concepts in spectroscopy are a resonance and its corresponding resonant frequency. In quantum mechanical systems, the analogous resonance is a coupling of two quantum mechanical stationary states of one system, such as an atom, via an oscillatory source of energy such as a photon. The coupling of the two states is strongest when the energy of the source matches the energy difference between the two states. The energy E of a photon is related to its frequency η by $E = h/\eta$, where h is Planck's constant, and so a spectrum of the system response versus the photon frequency will peak at the resonant frequency or energy. Particles such as electrons and neutrons have a comparable relationship, the de Broglie relations, between their kinetic energy and their wavelength and frequency and, therefore, can also excite resonant interactions.

The types of spectroscopy are distinguished by the type of radiant energy involved in the interaction. In many applications, the spectrum is determined by measuring changes in the intensity or the frequency of this energy. Electromagnetic radiation was the first source of energy used for spectroscopic studies. Techniques that employ electromagnetic radiation are typically classified by the wavelength region of the spectrum and include microwave, terahertz, infrared, near-infrared, visible and UV, and x-ray and gamma spectroscopy. The types of spectroscopy are also distinguished by the nature of the interaction between the energy and the material. Absorption occurs when energy from the radiative source is absorbed by the material; it is often determined by measuring the fraction of energy transmitted through the material; absorption will decrease the transmitted portion. Emission indicates that radiative energy is released by the material. A material's blackbody spectrum is