Spectroscopy comes from the Latin “spectron” for spirit or ghost and the Greek “σκοπεῖν” for to see. These roots are very telling, because in molecular spectroscopy you use light to interrogate matter, but you actually never see the molecules, only their influence on the light. Different spectroscopies give you different perspectives. This indirect contact with the microscopic targets means that the interpretation of spectroscopy in some manner requires a model, whether it is stated or not. Linear spectroscopy commonly refers to light-matter interaction with one primary incident radiation field which is weak, and can be treated as a linear response between the incident light and the matter. From a quantum mechanical view of the light field, it is often conceived as a “one photon in/one photon out” measurement. Nonlinear spectroscopy is used to refer to cases that fall outside this view.
2: Diagrammatic Perturbation Theory

3: Third-Order Nonlinear Spectroscopies

4: Characterizing Fluctuations
5: Two-Dimensional Spectroscopy

Thumbnail: Plot of the field of an ultrashort pulse, as well as its time-averaged intensity. (CC BY-SA 3.0 unported; Zueignung and edited by LibreTexts via Wikipedia)