Abstract: There are various types of optical spectra to characterize and to understand materials. Interpretations have naturally been made based on linear responses of the light-matter interaction, where amounts of the signal are proportional to the incident intensity. However, there are also varieties of the optical phenomena in nature that show the nonlinear dependence. Moreover, they are associated with events, such as second harmonic generation, that are unusual in everyday life but critical for our scientific development. These special phenomena are typically induced with the ultrashort pulse light source, i.e. laser, and the recent technical innovations have pushed the controllable photon energy up to the X-ray region. “X-ray” was named after a ray of “something unknown (X)” by Röntgen and it has been a significant experimental probe to investigate structure and electronic states of materials. Today, we have gotten a new approach and we are able to conduct the nonlinear X-ray experiments with X-ray lasers. In this talk, I would like to present such a rise of the nonlinear X-ray spectroscopy for materials science and discuss the future prospects of the new technique.

Short Bio:

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