

# Controls of octahedral rotation in perovskite oxides: for designing functional materials

Wonshik Kyung<sup>1,2</sup>

1. Center for Correlated Electron Systems, Institute for Basic Science (CCES-IBS)
2. Department of Physics and Astronomy, Seoul National University (SNU)

One of the key goals in the research of perovskite transition metal oxides (TMOs) is to design and control their physical properties, for which  $\text{MO}_6$  (M=transition metal) octahedron rotation (OR) is considered to be one of the key control parameters. Thus, changing OR at will might be one of the ways to obtain desired physical properties in perovskite materials. However, in spite of importance, there are only limited number of reports on controlling OR. The main reason is that the OR angle is believed to be an inherent characteristic of a material determined by the steric effect stemming from the sizes of constituent atoms.

In my talk, I will show our researches regarding the control of OR with two ways; electric field and charge carrier doping. In the first part, the electric field driven OR in  $\text{Sr}_2\text{RuO}_4$  will be introduced. Through a combined study of angle-resolved photoemission, low electron diffraction and first-principle calculations, we discovered (and proved) that OR can be induced and thus be tuned with electric field. In the second part, our researches on the origin of OR in  $\text{SrRuO}_3$  will be presented. Our pump-probe X-ray scattering result reveals that OR in  $\text{SrRuO}_3$  can be suppressed with pump-light. With the help of first-principle calculation, we revealed that the OR in  $\text{SrRuO}_3$  does not come from conventional steric effect, but from excitonic mechanism, which suggests possible control of OR via charge carrier doping. Our discoveries regarding the control of OR (electric field and charge carrier doping) not only shed light on the mechanism of OR in perovskite materials, but also are an important step towards the design of functional materials through the OR angle variation.