Most Young Scholars Grant (Einstein Program): Exploring New Possibilities – Role of Complex Oxides

Jan-Chi Yang
Department of Physics, National Cheng Kung University
janchiyang@phys.ncku.edu.tw

Oxide materials are gifted systems which have attracted lots of attention over past decades. These materials provide a variety of intriguing functional properties, including superconducting, piezo/ferroelectric, magnetic, high-dielectricity, ferromagnetism, colossal magnetoresistance, transparaent-conducting and etc., where typical examples and configurations are listed in Fig. 1. With proper control, the interplays between charge, lattice, orbital and spin degrees of freedom in complex oxides enable us to design materials with new functionalities. The fundamental understanding of the physical origin of these phenomena is crucial in order to develop the principles for materials design and to exploit the remarkable properties of these materials for new practical devices.

Prof. Jan-Chi Yang established the laser molecular beam epitaxy (Laser-MBE) lab at Department of Physics since August 2017. He is an experimental researcher who is highly interested in understanding complex phenomena in novel materials of fundamental and/or technological importance with the aid of multiple complementary experimental techniques. He believes that the scientists have great potentials to fundamentally change our view of the modern world, to significantly impact the technology, and to provide new solutions to our energy issues. In the past years, he mainly focuses on the growth and creation of functional materials, interfaces, heterostructures, nanostructures and free-standing matters via laser-MBE techniques, and recently he’s trying to use the synchrotron-based techniques and transport measurements to reveal the answers to the charming and fascinating physics in quantum materials. His main goal is to strike an elegant balance between physics and materials science for creating new quantum materials with new functionalities and for unveiling the intriguing interplays more comprehended. His papers have been published in Nature Commun., Phys. Rev. Lett., Advanced Mater., ACS Nano, Nano Letters, PRB, and so on. In 2018, he was awarded the Einstein program, founded by Ministry of Science and Technology (MOST).
Fig. 1 Classical categories in complex oxides and the wide spectrum of quantum materials composed of complex oxides.

Laser-MBE lab was found to tackle various problems arising under the above research themes using the various techniques. The advanced growth of functional materials has played an important role to initiate the bloom of green electronics and novel applications. Fig. 2 shows the initial setup of Prof. Jan-Chi Yang’s group. In the foreseeable future, he plans to combine his expertise in advanced growth, synchrotron-based techniques as well as transport measurements to study and to develop new complex oxides, especially fascinating oxide homo-, hetero- and nano- structures. Laser-MBE lab is also open for collaboration in developing intriguing physics and functionalities in new materials.

Fig. 2 Lab setup of Laser-MBE lab at Department of Physics, NCKU.