中央大學物理學系

Department of Physics, National Central University



## Colloquium

## **Bilayer Quantum Computer and other**

## **Applications of 2D Layered Materials**

# Prof. Yuan-Ron Ma(馬遠榮)

Distinguished Professor, Department of Physics, National Dong Hwa University / Vice President, Fo Guang University 東華大學物理系特聘教授/佛光大學副校長

#### Date: 2025/03/11(Tue) Venue: S4-625 Time: 14:00-16:00

Abstract : Recently two-dimensional (2D) layered materials have attracted many attentions, because they can be easily and precisely exfoliated to be only a monolayer or few layers due to the weak van der Waal forces between the stacked layers. In fact, the unique and special properties [1-5] of the monolayer and few layers have facilitated the rapid development of electronics and spintronics based on monolayer [1,2], bilayer [3,4], few-layer [5] and so on. Our laboratory at National Dong Hwa University (NDHU), Taiwan has synthesized more than ten 2D layered materials, such as CrI3, VI3, GaTe, SnS2, Bi2S3, NiPS3, and so on, and some interesting results have been already published [6-10]. We use the energy-resolved magnetic circular dichroism (MCD) spectropolarimetry possessing the excellent capability to detect the magneto-optical characteristics of d-d transitions and spin behaviors in applied magnetic fields. The MCD spectra provide a specific signals of two-qubit (2Q) quantum states ( $\equiv |\psi\psi\rangle$ ) of |01> and |10> from a 2D bilayer CrI3 for quantum information. A 2D monolayer CrI3 possessing the ferromagnetic (FM) nature of out-of-plane Ising spin-up (or spin-down) electrons can be considered as a gubit with a quantum state of  $|\psi\rangle = |\rangle = |0\rangle$  (or  $|\psi\rangle = |\psi\rangle = |1\rangle$ ) due to the theory of the Bloch sphere. Hence, an FM or antiferromagnetic (AFM) bilayer CrI3 can be reflected two qubits for quantum information or quantum computer.