



Prof. Hyunseok Jeong

**Title: Towards resource-efficient and fault-tolerant quantum computation with light**

**Abstract:**

Schemes for all-optical quantum computation have been developed mainly using single-photon qubits, entangled photon pairs, passive linear optics elements and photodetectors. This type of approach is well known as "linear optics quantum computation." A formidable limitation to this method is that some crucial gate operations, necessary either for in-line computation or for off-line resource-state generation, cannot be performed in a deterministic way, or it can be done only with increasingly large resources. Recently, several approaches have been developed to overcome this obstacle using different types of qubits beyond single-photon qubits. I will discuss how these schemes can be used to overcome limitations of previous schemes and expedite fault-tolerant and resource-efficient quantum computing. In particular, our new approach with hybrid cluster states is shown to significantly improve both the resource efficiency and the fault-tolerant threshold at the same time. I will also discuss unified quantifications of various quantum properties as resources for quantum information processing.