

# Joint CQSE & NCTS Seminar

2023  
Apr. 07, Friday

TIME Apr. 07, 2023, 14:30~15:30pm

TITLE Towards a robust frequency-encoding quantum-key-distribution in fiber network

SPEAKER Prof. Pin-Ju Tsai

(Department of Optics and Photonics, National Central University)

PLACE NCTS Physics Lecture Hall, 4F, Chee-Chun Leung Cosmology Hall, NTU

ONLINE <https://nationaltaiwanuniversity-zbn.my.webex.com/>



## **Abstract:**

In this talk, a novel and robust quantum key distribution protocol, called the decoy-state frequency-correlated QKD (DS-FCQKD), will be proposed. This protocol considers utilizing the time-frequency entanglement of spontaneous parametric down-conversion (SPDC) photon-pairs to encode the information, its highly entangled nature has the potential to implement large-alphabet encoding and further increase the secure key rate (SKR). For the protocol's security, our analysis shows even though Eve executes the intercept/resend (IR) attack with the optimal conditions, the decoy-state method will force Eve to send an error signal into the system which induces a considerable quantum-bit-error rate (QBER), and further ensure the security of the protocol. Since the frequency encoding of DS-FCQKD, effectively avoids the polarization mode dispersion (PMD) and phase fluctuation in optical fiber, moreover, not need interferometers. This simple setup can significantly reduce the complexity of the experimental system and has the huge potential to be implemented with realistic devices. In experimental realization, we preliminary verified the time-frequency entanglement of our source SPDC by a Franson interferometer. We observed high visibility of 94% of nonlocal interference which demonstrated the high entanglement of the source. By utilizing the optical fiber network on NCU campus, furthermore, we demonstrated the time-frequency entanglement distribution at a distance of 2.64 km. By combining the novel protocol we proposed and the developed entangled-photon-source, in the future, the scheme has a high potential toward a high-performance, robust, and practical QKD network on NCU campus.

## **Biography Brief:**

Experience:

Education-

2004-2009 B.S. in Physics, Soochow University, Taiwan

2010-2013 M.S. in Physics, National Cheng Kung University, Taiwan , Thesis advisor:  
Prof. Yong-Fan Chen

2014-2019 Ph.D. in Physics, National Taiwan University, Taiwan, Thesis advisor: Dr.  
Ying-Cheng Chen

Experience-

Postdoctoral research fellow, Institute of Atomic and Molecular Sciences (IAMS),  
Academia Sinica 2019/8-2019/12

Assistant research fellow and engineer, National Chung-Shan Institute of Science and  
Technology (NCSIST) 2019/12-2021/1

Postdoctoral research fellow, Institute of Atomic and Molecular Sciences (IAMS),  
Academia Sinica 2021/1-2022/2

Project Assistant Researcher, Dept. of Physics, NCU 2022/2-2023/2

Assistant Professor, Department of Optics and Photonics, National Central University  
2023/2 -

