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The University of Hong Kong



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FACULTY OF ENGINEERING

SEMINAR

Zero carrier-envelope-offset Mid-infrared frequency combs for molecular spectroscopy

Date: 15 May, 2023 (Monday)
Time: 3:00 p.m.
Venue: Tam Wing Fan Innovation Wing Two
G/F, Run Run Shaw Building, HKU

Speaker: Prof. Sida Xing
Shanghai Institute of Optics and Fine Mechanics
China



Abstract:

Time represents mankind's most precisely measured quantity. The new SI system redefined other five units as function of a physical constant and the SI second. Optical frequency comb bridges the gap between optical frequency (10^{14} Hz) and radio frequency (10^{10} Hz), promising an even more precise time-keeping capability. In the frequency domain, an optical frequency comb maps absorption features of molecules directly to the SI time standard. Precise and fine-resolved absorption lines enable not only the retrieval of molecular species, but its pressure, temperature and speed. In the temporal domain, two synthesized electrical fields yield "static" interferogram, leading to coherent averaging at ultra-high precision, speed and dynamic range. After a brief introduction optical frequency comb basics, this talk covers a few potential spectroscopic applications utilizing frequency combs. I will then explain our approach of generating a stable electric field in the mid-infrared for spectroscopic applications from $6\ \mu\text{m}$ to $25\ \mu\text{m}$ at 100 MHz resolution and 100 dB dynamic range.

Biography:

Prof. Sida Xing received his BEng (2013) and MEng (2015) from McGill University. He worked on mid-infrared fiber lasers since 2015 and received PhD from École Polytechnique Fédérale de Lausanne (EPFL) in 2019. From 2019 to 2021, he conducted postdoctoral research in the Time and Frequency Division of National Institute of Standards and Technology (NIST) with Prof. Scott Diddams. In NIST, he built the first all-fiber single cycle frequency comb. In 2022, he joined Shanghai

Institute of Optics and Fine Mechanics with full professorship. Prof. Xing currently carries out research in the fields of nonlinear fiber optics, fiber lasers/amplifiers and mid-infrared frequency comb spectroscopy. Prof. Xing currently serves as the committee member of CLEO optical metrology session.

References:

- [1] J. Hall, "Nobel lecture: Defining and measuring optical frequencies," *Rev. Mod. Phys.* 78, 1279–1295 (2006).
- [2] S. Diddams, K. Vahala, and T. Udem, "Optical frequency combs: Coherently uniting the electromagnetic spectrum," *Science*. 369, (2020).
- [3] A. Kowligy, H. Timmers, A. Lind, U. Elu, F. Cruz, P.Schunemann, J. Biegert, and S.Diddams, "Infrared electric field sampled frequency comb spectroscopy," *Sci. Adv.* 5, eaaw8794 (2019).
- [4] D. Lesko, H. Timmers, S. Xing, A. Kowligy, A. Lind, and S. Diddams, "A six-octave optical frequency comb from a scalable few-cycle erbium fibre laser," *Nat. Photonics* (2021).
- [5] S. Xing, D. Lesko, T. Umeki, A. Lind, N. Hoghooghi, T. Wu, and S. Diddams, "Single-cycle all-fiber frequency comb," *APL Photonics* 6, 86110 (2021).
- [6] N. Hoghooghi, S. Xing, P. Chang, D. Lesko, A. Lind, G. Rieker, and S. Diddams, "Broadband 1-GHz mid-infrared frequency comb," *Light Sci. Appl.* 11, (2022).

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. X.B. Yin at 3910 2659.