=== 量子科学研究センターセミナーのご案内 ===

6/21（金）に米国コロラド大学ボルダー校より、Scott Diddams 教授の研究グループの Connor Fredrick 博士と Pooja Seckhar さんの 2 名をお招きし、量子科学研究センターセミナーを開催致しますので、ご案内致します。

Scott Diddams 教授は、光周波数コム、精密計測、量子光学の研究において世界を牽引する研究者で、本学の特別栄誉教授 John Hall 先生が 2005 年にノーベル物理学賞を受賞された研究においても多大な貢献をされています。

今回、同グループのメンバーである Connor Fredrick 博士と Pooja Seckhar さんが、横浜で開催される天文学の国際会議に参加される機会に本学を訪問されます。

本セミナーでは最新の研究成果をご紹介いただきますので、研究室の研究員、学生の皆様もお誘いあわせのうえ、どうぞ奮ってご参加ください。

[講演情報]
日時：2024 年 6 月 21 日(金) 16:30 - 17:30
場所：東 6 号館 337 室
主催：量子科学研究センター

[1]
Title: Precision near-infrared solar spectroscopy with a frequency comb calibrated laser heterodyne radiometer

Speaker: Dr. Connor Fredrick, the University of Colorado Boulder

Abstract: For many important optical and infrared systems of interest, such as those in astronomy and atmospheric remote sensing, spectroscopic information is carried by light that is thermal in origin. With incoherent light, it is not possible to use the phase-sensitive or frequency counting techniques of optical frequency metrology, and one is restricted to measuring the amount of radiation instead of its frequency. Laser heterodyne radiometry is a compelling option for making spectral measurements of thermal light at known frequencies. We report on the design and development of a frequency-comb-calibrated near-infrared heterodyne spectrometer. We use this comb-calibrated approach to measure a solar iron line using two instrument configurations: one that measures the line shape of the target transition at high resolution ($R\sim10^6$), and another that uses lock-in detection to stabilize a laser to the target transition, directly tracking its frequency against the comb. In both configurations, the measurements reach sub-50 cm/s Doppler velocity precision within a single day.

Bio:
Connor Fredrick is a postdoctoral associate at the University of Colorado Boulder and works in Scott Diddams' group at NIST. His research spans laser spectroscopy, nonlinear optics, and optical frequency combs with an emphasis on precision astronomical applications. Of note are his contributions to the development and long-term operation of the 30 GHz comb system used with the near-infrared Habitable-Zone Planet Finder spectrograph. More recently, Connor has focused on exploring the limits of comb-calibrated heterodyne radiometry for high-resolution solar spectroscopy.

[2]
Title: Tunable laser frequency combs for astronomical spectrograph characterization and calibration

Speaker: Pooja Sekhar, the University of Colorado Boulder

Abstract: The discovery and characterization of earth-like exoplanets by radial velocity technique is an extremely challenging spectroscopy problem. Currently, detector defects, stellar activity and the absence of a reliable laser frequency comb (LFC) around the peak of the solar spectrum are major impediments to reaching the required 10^{-10} level of RV precision. To address these challenges, tunable LFCs that can map the point spread function across a spectrograph's entire bandwidth are required. This talk demonstrates a scannable 30 GHz electro-optic (EO) comb spanning 700 – 1300 nm by tuning a combination of laser center frequency and mode spacing. This talk also delves into the development of LFCs in 350 – 500 nm band using periodically-poled lithium niobate waveguides leveraging both $\chi^{(2)}$ and $\chi^{(3)}$ nonlinearities.

Bio:
Pooja Sekhar is a PhD student in Physics at University of Colorado Boulder. She received her BSMS degrees in Physics from IISER Thiruvananthapuram (India). She joined Scott Diddams' research group in 2020 and is currently working on the development of laser frequency combs to calibrate astronomical spectrographs aimed at finding exoplanets.

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