IEEE METROPOLITAN LOS ANGELES SECTION
PHOTONICS SOCIETY CHAPTER

Ultrastable laser for high precision physics

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AGENDA

11;00 a.m. – Dr. Hennessy wilcall the meeting to order

11:05 – Dr. Matsko will introduce the Speaker

11:50 the Audience ask questions
12:00 Dr. Hennessy will present our speeer an Award and will Adjourns the meeting.

The IEEE Photonics Chapter present a special lecture event

Ultrastable lasers based on Fabry-Perot cavities are playing as the core components in the highest precision measurements. For example, such narrow linewidth lasers provide high phase coherence for gravitational wave detectors or very-long-baseline interferometers, high stability for optical atomic clocks, and low phase noise for optical-to-microwave synthesizer. The advancement of the ultrastable laser relies on the optimization of the cavity thermal noise floor, the ultimate limit of laser linewidth, which is determined by the cavity materials. A typical cavity, made by ultralow expansion glass as cavity spacer, fused silica as mirror substrate and SiO_2/Ta_2O_5 as high-reflective coating, provides sub-Hz level linewidth with 0.1 Hz/s drift rate. The state-of-the-art cavity with low noise and drift is made with single crystal silicon, with operating near 124 K or 17 K, enabling a stability level of 4×10^{-17} with 0.1 mHz/s drift. For the fieldable applications, such as space missions, geodesy or portable optical clocks, where the size, weight and power are the primary considerations, bulk resonators with mm-scale have been demonstrated to provide the sufficient reduction of laser linewidth. In this presentation, we will review the development of the stable laser along with the improvement of the thermal noise floor. Then, we will give a completed description regarding to the state-of-the-art silicon cavities, and the latest cavity system design for NASA/JPL projects.

Dr. Wei Zhang is an optical engineer of Frequency and Timing Advanced Instrument Development Group at JPL. He received the Ph. D. degree in 2009 from Institute of Physics, Chinese Academy of Sciences, and the research focused on titanium-sapphire-based femtosecond laser frequency comb and absolute optical frequency measurement. From 2009 to 2012, he worked at SYRTE, Observatoire de Paris, France, for low phase noise microwave generation by optics-to-microwave frequency division with ultrastable laser and fiber-based frequency comb. From 2012 to 2019, he was with JILA, University of Colorado at Boulder and Time and Frequency Division of NIST to develop several cavities systems for ultrastable lasers. He has been with JPL as optical engineer since 2020 and keeping the research on optical oscillators

RSUV **with your membership # to shouhua.huang@jpl.nasa.gov and eremitam@outlook.com. You will receive the login link from Dr. Hennessy the Meeting Chair.**