CFEL SCIENCE

# SEMINAR

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# Low phase noise microwave generation with fiber frequency combs


Low phase noise microwave signals are widely used in scientific applications, such as radar, deep space navigation, timing distribution and synchronization. The photonic approach, combing ultrastable laser and frequency comb provides a promising low-phase-noise signal source with superior performance. In this approach, an ultrastable laser with stability of $10^{-15}$ is used as the optical reference and a frequency comb as the optics-to-microwave frequency divider.

The detection and demodulation of the optical pulse train is accompanied by various excess noise processes which limit the residual phase noise of the photonics approach. This presentation will introduce several techniques for low phase noise signal generation at LNE-SYRTE. To improve the flicker noise floor in measurement system, we implement a low-noise carrier-suppression scheme and generate a residual phase noise as low as -120 dBc/Hz at 1 Hz offset from 11.55 GHz (single system). The amplitude-to-phase conversion in photodetection is measured and optimized to reduce the excess phase noise transferred from laser relative intensity noise. To remove the residual noise due to limited bandwidth of frequency comb, a prototype comb equipped with an intracavity electro-optic modulator is characterized by measuring several critical transfer functions. The level of microwave signal at 12 GHz is increased by 18 dB by applying a cascade pulse repetition rate multiplier. As a result, we demonstrate a residual phase noise of -118 dBc/Hz at 1Hz and -160 dBc/ Hz at 10 MHz offset from 12 GHz (single system).


Host: Franz X. Kärtner, CFEL UX Seminar