The Beams and Applications Seminar Series

AM and PM noise in RF / microwave and photonic systems

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Bldg. 401, Room A1100
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Host: A. Nassiri / T. Berenc, ASD

Random phase fluctuations affect precision and accuracy of timing. Random amplitude fluctuations, far less studied, may limit the most demanding experiments and systems. Phase noise is usually described in terms of the one-sided power spectral density of the random phase. Other quantities often used and related to are the spectrum of the fractional frequency fluctuation, and the two-sample (Allan) variance as a function of the measurement time. The same apply to the fractional amplitude fluctuation.

Besides obvious thermal noise and shot noise, AM and PM noise arise from near-dc phenomena that modulate some parameter. This describes flicker, and also fluctuations of the environment. The rules to propagate AM-PM noise through a system depend on the noise type, and may be surprising.

PM noise is often measured by converting into a voltage with a mixer. The measurement of oscillators requires a reference, either another oscillator or a discriminator. Ultimate sensitivity is achieved by amplification and detection of the noise sideband, after suppressing the carrier. Correlation and averaging help to reject the instrument noise when the signal is measured with two separate (statistically independent) instruments, each of which adds its noise. The sensitivity is limited by the thermal homogeneity, instead of the absolute temperature.

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