17TH ADVANCED BEAM DYNAMICS WORKSHOP ON
FUTURE LIGHT SOURCES

Fluctuation Measurement of Short Bunch Length

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APRIL 6-9, 1999
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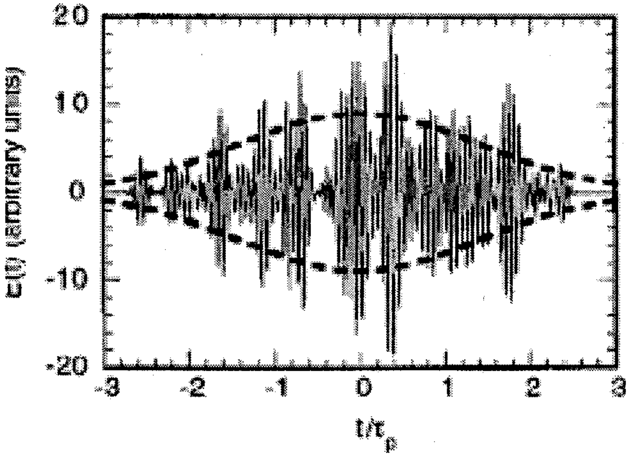
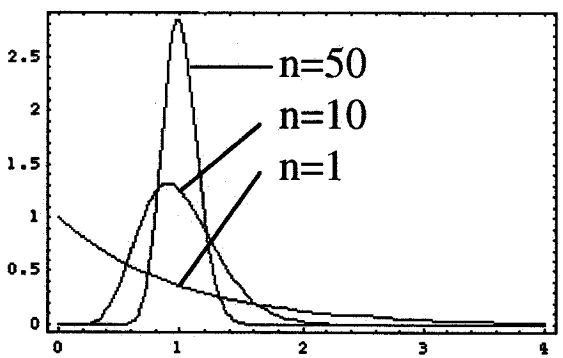


This how look input signal for amplifier. Before saturation, system was linear, and as result of slippage, bunching became superposition of this noise.
After saturation (bunching can not be >1) different pieces of noise start compete with each other and destroyed bunching. As a result is spectral broadening.

Number of spikes is $n \approx \dfrac{c\tau_b}{\lambda M_g \sqrt{Log[gain]}}$ (in linear case)

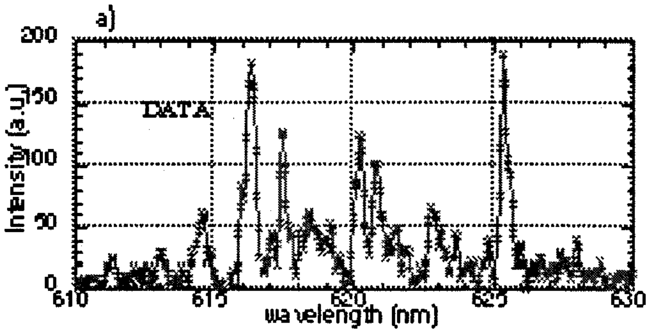
Each spike are independent and fluctuation of normalized intensity will follow of distribution of sum **n** independent Poisson process Gamma[n] distribution.

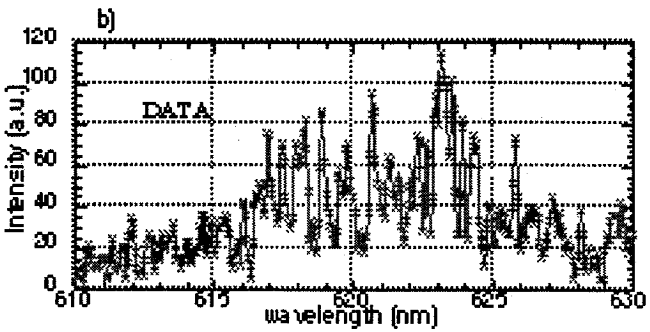


$$f(x;n) = \frac{x^{n-1} n^{n} e^{-nx}}{\Gamma(n)}$$

$$< x >= 1; \quad Variance = n$$

Spectral fluctuation





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Spectral fluctuations: narrow spicks with width $1/\tau_{b.}$ In case of pure resolution of spectrometer or mixing radiation from source large than transverse coherence size or both distribution of normalize intensity of spikes will be Gamma distribution