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Influence of Noise on Time Evolution of Intensity Correlation Function

CHENG Qing-Hua,[1,2] CAO Li,[2] XU Da-Hai,[1] and WU Da-Jin[3]

[1] School of Physical Science and Technology, Yangtze University, Jingzhou 434100, China
[2] State Key Laboratory of Laser Technology, Huazhong University of Science and Technology, Wuhan 430074, China
[3] CCAST (World Laboratory), P.O. Box 8730, Beijing 100080, China
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Abstract: Using the linear approximation method, we have studied how the correlation function C(t) of the laser intensity changes with time in the loss-noise model of the single-mode laser driven by the colored pump noise with signal modulation and the quantum noise with cross-correlation between the real and imaginary parts. We have found that when the pump noise self-correlation time τ changes, (i) in the case of $\tau<<1$, the C(t) vs. t curve experiences a changing process from the monotonous descending to monotonous rise, and finally to the appearance of a maximum; (ii) in the case of $\tau>>1$, the curve only exhibits periodically surging with descending envelope. When $\tau<<1$ and τ does not change, with the increase of the pump noise intensity P, the curve experiences a repeated changing process, that is, from the monotonous descending to the appearance of a maximum, then to monotonous rise, and finally to the appearance of a maximum again. With the increase of the quantum noise intensity Q, the curve experiences a changing process from the monotonous rise to the appearance of a maximum, and finally to the monotonous descending. The increase of the quantum noise with cross-correlation between the real and imaginary parts will lead to the fall of the whole curve, but not affect the form of the time evolution of C(t).

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