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Noise fluxes produced by the cavity Langevin force in class-A and -B lasers

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Abstract

Since 1970, all laser specialists have unanimously reported that the laser noise is only produced by the two atomic population inversion and atomic dipole moment Langevin forces, and the effect of cavity Langevin force is quite negligible. This general opinion has been doubted when we decided to approximate the magnitude order of latter force on the noise profile of class-A lasers in 2012. It has peculiarly turned out that the cavity Langevin force is able to generate the noise flux with a single peak profile (Lorentzian profile) which is in complete agreement with the experimental gain and noise profiles of argon-ion and krypton-ion lasers, as class-A lasers. This agreement indicates the lasers undertake the same mechanism in amplifying an input signal as superimposing noise fluxes on their variables. Then, this idea is successfully extended to calculate the noise flux of laser pumping that is superimposed on the spontaneous emission and stimulated emission (laser) radiations in class-B lasers in 2013. The laser noise flux now demonstrates a symmetrical double-peak profile around the cavity resonance frequency, which is completely compatible with the experimental results of the heterodyne gain profile of a CO2 laser, as a class-B laser. In both class A and B lasers, the results confirm that the noise fluxes of the cavity Langevin force are not only negligible, but are comparable with those produced by the sum of atomic population inversion and dipole moment Langevin forces.

Biography

Jafar Jahanpanah received the B.Sc. degree in applied physics from Amir Kabir (Tehran Polytechnic) University, Tehran, Iran, in 1989, the M.Sc. degree in optics communication, and the Ph.D. degree in laser theory from Essex University, Colchester, U.K., in 1992 and 1995, respectively. He is an Associate Professor of physics and has been the Chairman of the Science Faculty at Kharazmi University since 2009. His current research interests include laser noise and also the gain, stability, and mode-locking phenomena in multi-mode lasers. He has publications in journals of PRA, OSA, Applied Physics, Laser physics, J. Phys. B, and Optics Communications.