Quantum Correlations on Biphotons Generated from an Ensemble of Cold Two-Level Atoms Close to Resonance

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In this work, we report nonclassical correlations generated from light scattered around the resonance of an ensemble of cold rubidium-87 two-level atoms *via* spontaneous four-wave mixing (SFWM). For this purpose, it was necessary to use a temporal scheme to prepare the atoms in the hyperfine manifold $5S_{1/2}(F = 2)$ and also excite the sample with light with circular polarization, enabling optical pumping to an extreme Zeeman sublevel: $5S_{1/2}(F = 2, m_F = 2)$ to $5P_{3/2}(F' = 3, m_{F'} = 3)$. In addition, in order to verify whether there are nonclassical correlations in the system, we use as mathematical tool the Cauchy-Schwarz inequality. Our experimental setup consists of two counter-propagating pump fields with frequencies close to atomic resonance, with, consequently, pairs of photons spontaneously emitted in opposite directions. The SFWM output signals are collected with single-mode fibers that arrive at four single photon detectors (model SPCM-AQRH-13-FC from Perkin Elmer). In closing, we observe the statistics of photon pairs emitted from cold atoms in a regime close to resonance and the influence of the optical depth (OD) on this regime, by fixing the detuning and varying the OD.