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BELL INEQUALITY VIOLATION BY ENTANGLED SINGLE PHOTON STATES GENERATED FROM A LASER, A LED , OR A HALOGEN LAMP

We present an experiment regarding the CHSH inequality violation by single photons, thus concerning the failure of contextuality instead of locality in quantum physics. Single photons are generated by different sources (Laser, led and a halogen lamp). This experiment proves that it is possible to continuously pass from a quantum description of CHSH inequality violation, where violation implies no classical non-contextual description, to a completely classical description where CHSH are violated in terms of classical intensities. The crucial difference regards the possibility to count single photons. The results of the experiment can have applications in the implementation and certification of quantum random number generators (QRNG) and to increase the security of QKD protocols. Our results confine the need of expensive sources of single photons, e.g. heralded photons, to those Quantum Information protocols that require a deterministic time of arrivals of the single photons.

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