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Modeling of the semi-classical states of the Electromagnetic field through the vector potential.

Implications in interaction with materials surfaces and in tele-detection .

The modeling of the electromagnetic waves for scientific and industrial applications is actually carried out through the electric and magnetic fields representations. However, according to Maxwell's equations, both of these fields derive from the vector potential. The experimental evidence in the past years has demonstrated that the vector potential is not a mathematical artefact and that it corresponds to a real physical entity. This is the reason why in Quantum Electrodynamics the interaction Hamiltonian between an electromagnetic wave and the electrons is expressed through the vector potential operator. Consequently, the vector potential is the natural link between the quantized expressions of the electromagnetic field and the classical ones.

In this study we propose to model the electromagnetic waves through the vector potential with quantized amplitude corresponding to an ensemble of single photon states within a nonlocal representation. The purpose is to improve our knowledge in the interaction mechanisms of light with matter.