High-order harmonics as induced by a quantized field: a phase-space picture

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The interaction of matter with a quantized electromagnetic mode is considered. Representing a strong exciting field, the mode is assumed to contain a large number of photons. As a result, the material response is highly nonlinear: the completely quantized description results in generation of high harmonics. In order to understand the essence of the physical processes that are involved, we consider a finite dimensional model for the material system. Using an appropriate description in phase space, this approach leads to a transparent picture showing that the interaction splits the initial, exciting coherent state into parts, and the rapid change of the populations of these parts (that are coherent states themselves) results in the generation of high-order harmonics as secondary radiation. The method we use is an application of the discrete lattice of coherent states that was introduced by J. von Neumann.

Reference

Á. Gombkötő, S. Varró, P. Mati, P. Földi, Phys. Rev. A. **101** (2020) 013418.