Prospects concerning 1D photonic crystals in the X-ray range

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It has been demonstrated that X-ray free-electron lasers (XFELs) allows to create strong population inversion by removing sufficient core-electrons in the atoms of a medium [1,2]. This results in a “stimulated” fluorescence.

Besides this, using an adequate multilayer material allows one to obtain a resonant standing-wave inside the material, which is equivalent to the use of a cavity [3,4,5].

We present here a prospective study of the diffraction of stimulated emission inside a periodic structure, in the x-ray range. For that purpose, we present here a theoretical study of the interaction of monochromatic x-ray photons with a bulk multi-layer sample and, of the resulting “stimulated” fluorescence. X-ray energy deposition (and pumping) as well as fluorescence, are modeled through a calculation of the radiation field in the material, which in turn depends on the complex refraction index linked to a complex NLTE atomic physics [6].

Different case-calculations of the diffracted K□ fluorescence are discussed. In particular, one discusses the possibility of enhancing fluorescence by using the periodic structure as a resonator (1D photonic crystal).

References

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