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Theoretical investigation of fluorescence and photoelectrons angular distribution in a XUV-pump XUV-probe scheme in C III ion

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We theoretically investigate the angular distributions of fluorescence and photoelectrons emission based on density matrix formalism [1] in a pump-probe scheme dedicated for measuring the lifetime of odd singlet excited states of C III [2]. The energy levels, bound-bound and bound-free electric dipole matrix elements belonging to C III have been computed with the Dirac-Fock-Slater model-potential method in combination with the distorted wave approximation for free states [3]. The quasi-bound states embedded in continuum are treated within time-independent perturbation theory [4]. During the pumping stage, triplet states also couple to the singlet ground state through spin-flip transitions affecting the overall yield and angular distribution of fluorescence. Similarly, during the probing stage, the ensemble of atoms excited in closely-lying states participate in the photoionization process, altering the expected C IV ion yield and the partial wave expansion of photoelectrons. The composition of the latter is investigated and highlighted by comparing the electron polarization [5] in the case of photoionization of carbon ions excited within a single state versus photoionization from a similar ensemble excited into multiple closely-lying states.

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