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Opinion

Role of Fullerenes Shell in Time Delay of Photoelectrons from Endohedrals

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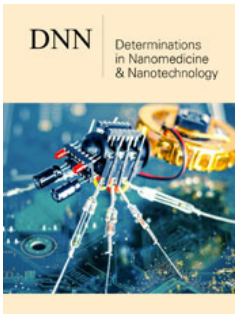

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Opinion

In this work we investigate the time delay of photoelectrons by the fullerenes shell in endohedrals. We present the general formulas in the frame of the Random Phase Approximation with Exchange (RPAE) applied to the endohedrals $A@C_N$, that consist of an A atom located inside a fullerenes shell consisting of N carbon atoms C. We calculate the time delay of electrons that leave the inner atom A in course of $A@C_N$ photoionization. Our goal is to find out the role played by the C_N shell. We considered Ne, Ar, Kr and Xe as specific examples of A, and we consider C_{60} as fullerene. The presence of the C_{60} shell manifests itself in powerful oscillations of the time delay $\tau_n(\omega)$ of an electron ionized from a given *n* subshell by a photon with energy ω. Calculations are performed for the outer, subvalent and *d*-subshells. The time delay of the photoionization process τ_n as a function of the photon energy ω in atomic units is related to the amplitude phase $f_n(\omega)$ of the process under consideration by the following relationship [1]. The phases, their energy derivatives, and partial cross sections were obtained in RPAE for an isolated atom and in RPAE taking into account the static C-potential of fullerenes and the dynamic polarization G, denoted as RPAECG [2]. (Figure 1) shows the results of calculations for the Xe atom and $Xe@C_{60}$ endohedral. Note that the variation of the time delay is much stronger than the change in the partial cross sections. The dipole photoionization of the *nl* subshell makes it possible to obtain only phase differences from the experiment. The time delay depends on the phase itself, thus providing in principal new information about the photoionization amplitude.

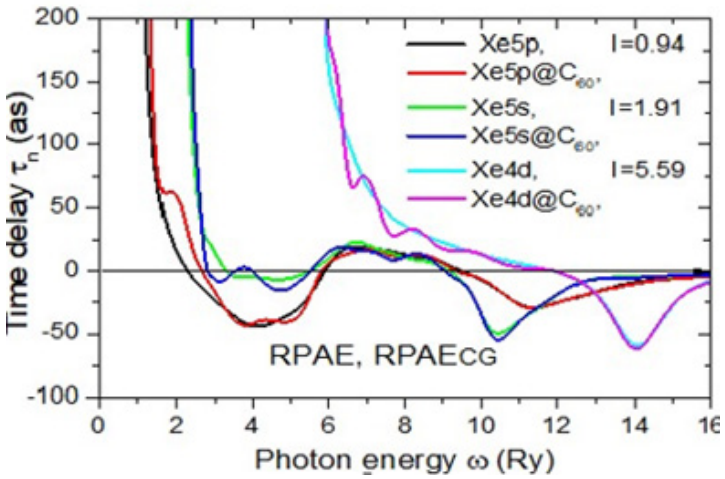

Figure 1: Time delay for 5p,5s,5d subshell of Xe and $Xe@C_{60}$.

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