Observation of selective charge distribution in SO2 after S 1s excitation: A femtosecond time scale problem

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We present the measured electron-multi-ion coincidence spectra after photo-excitation of the SO_2 molecule around the $S1s$ edge. A procedure for complete determination of all set of ions formed is described. The new measurements reported here relay on a new system capable to detect ions connected to the same ionization event arriving down to 1 nanosecond apart. The dissociation channels and its behavior with the photon energy of this molecule is presented in comparison with the Total Ion Yield (TIY). We observed a higher charge multiplicity in the sulfur atom, which is the excitation atom for SO_2 molecule. Auger cascade after the 1s core hole creation leading to $2p$ double hole states need to be taken in to account to explain these observations. The time scale of the nuclear motion and decay is discussed in order to explain the intra-atomic cascade Auger leading to the observed selective charge distribution. Recombination forming an O_2 ion was found.The experiment was performed at the " Laboratorio Nacional de Luz Sincrotron" - LNLS in Campinas, Brazil. We used exciting synchrotron radiation from the bending magnet Soft X-ray Spectroscopy beamline (SXS).
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