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Two-electron processes in relaxation of hollow atoms

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The M-X-rays emitted from Rydberg (n~30) hollow atoms (RHA) created in collisions of highly charged Xe^{q+} ions (q=23-36) with Be surface were measured and interpreted in terms of the MCDF calculations [1] as a cascade of nf-3d electric dipole X-ray transitions, including their M-shell hypersatellites. The measured X-ray spectra indicate the importance of two-electron processes, in particular the Internal Dielectronic Excitation (IDE) [2] and Two-Electron One-Photon (TEOP) transitions in relaxation of studied RHA. In fact, the observed M-X-rays for Xe^{26+} ions, that have no initial vacancies in 3d subshell, result from filling 3d vacancies formed exclusively by the IDE. We found a sharp cut-off for X-ray cascade at n~10-20, which supports the idea that for higher n-states the relaxation proceeds via the Interatomic Coulombic Decay (ICD) [3]. We demonstrate that present observations explain why the relaxation of RHA can proceed in the ultrafast timescale.

References
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