

INTERATOMIC DECAY IN CLUSTERS: NEW PERSPECTIVES IN
LIGHT OF XFEL

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Interatomic (intermolecular) decay of ionized and excited states of clusters is one of the highlights of contemporary chemical physics. The most prominent of this group of novel decay phenomena, interatomic Coulombic decay (ICD) [1], is an energy transfer between a cluster subunit bearing an innershell vacancy and another subunit, resulting in the ionization of the latter. First predicted theoretically in 1997 [2], ICD has recently become also an area of active experimental research [3]. In the first part of the talk, I will briefly review the current state of the subject making an emphasis on the new theoretical methodology for *ab initio* calculation of the interatomic decay rates [4] and on the ultra-fast character of ICD in endohedral fullerenes [5]. The second part of the talk will be devoted to the relevance of interatomic decay phenomena for the physics of interaction of XFEL radiation with clusters. In particular, I will discuss the role of ICD as the last step in cascades of electronic decay eventually leading to the Coulomb explosion of clusters [6] and the possibility of new interatomic decay processes in clusters with multiple inner-shell vacancies.

[1] *Physics Today* 57, 9 (2004).

[2] L. S. Cederbaum, J. Zobeley, and F. Tarantelli, *Phys. Rev. Lett.* 79, 4778 (1997).

[3] S. Marburger et al., *Phys. Rev. Lett.* 90, 203401 (2003); T. Jahnke et al., *ibid.* 93, 163401 (2004); G. Öhrwall et al., *ibid.* 93, 173401 (2004).

[4] V. Averbukh and L. S. Cederbaum, *J. Chem. Phys.* 123, 204107 (2005).

[5] V. Averbukh and L. S. Cederbaum, *Phys. Rev. Lett.* 96, 053401 (2006).

[6] R. Santra, and L. S. Cederbaum, *Phys. Rev. Lett.* 90, 153401 (2003); Y. Morishita et al., submitted to *Phys. Rev. Lett.*