DYNAMICS OF LARGE FINITE SYSTEMS

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Chemical physics of large finite systems focuses on size effects on the structure, energy landscapes, phase changes, electron-nuclear energetics, response, dynamics, control and function of clusters, nanostructures, biomolecules, finite quantum systems and irradiated ultracold gases. We shall focus on recent explorations of finite system dynamics under extreme thermodynamic, energetic and temporal conditions. Ultraslow and ultralow phenomena pertain to ultracold systems (quantum clusters and optical molasses), ultralow charged (effective charges of 10^{-5}e, characterizing optical molasses), and ultraslow processes (excess electron tunneling from superfluid ^{4}He boson clusters). Ultrafast and ultrahigh phenomena pertain to extreme cluster ionization in ultraintense laser fields (peak intensities 10^{15}–10^{21} Wcm^{-2}), ultrafast femtosecond dynamics on the time scale of nuclear motion and attosecond-femtosecond electron dynamics, the production of ultrahigh charges (completely ionized $(D_2O)_n$ or $(CD_4)_n$ clusters or Xe^{36+} ions) in elemental and molecular clusters, and the attainment of ultrahigh energies (keV–MeV) in Coulomb explosion of multicharged clusters and nanostructures. Coulomb explosion of clusters and nano-structures transcend chemical-physical dynamics towards the driving of nuclear reactions involving table-top dd nuclear fusion and nucleosynthesis of astrophysical interest.

References:

1. M. Rosenblit and J. Jortner. Adv. Chem. Phys. **132**, 247 (2006).
2. A. Heidenreich, I. Last and J. Jortner. Proceed. Natl. Acad. Sci. USA **103**, 10589 (2006).
3. I. Last and J. Jortner. Phys. Rev. Lett. **97**, 173401 (2006); Nature "Research Highlight", November (2006).
4. I. Last and J. Jortner. Phys. Rev. A **75**, 042507 (2007).
5. I. Last and J. Jortner. Phys. of Plasmas **14**, 123102 (2007).
6. A. Heidenreich, I. Last and J. Jortner. Laser Phys. **17**, 608 (2007); J. Chem. Phys. **127**, 074305 (2007); Eur. Phys. J. D **46**, 195 (2008).