Kansas State University/USA: Triggering molecular transport via pulse magnetic fields

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The widespread use of nanoparticles in technology is still limited by the available tools at nanoscale to control their properties. Our group at Kansas State University exploring how to amplify magnetic fields effects on liposomal drug delivery systems and on cells for cancer therapy. We have been studying the effect of inhomogeneous magnetic pulses on strong inhomogeneous magnetic fields, which can produce localized ultrasound to alter permeability of lipid bilayers (*JPCB* **2014,** *118* (40), 11715-22). Magnetoliposomes (liposomes loaded with magnetic nanoparticles) combined with the intense inhomogeneous magnetic pulses can be used to develop rapid drug release methodology to address some of the shortcomings of currently available liposomes delivery systems (*Magnetochemistry* **2020**, 6(4), 52). In addition, we have shown (*ACS Applied Materials & Interfaces* **2020**, 12 (12), 13657-13670.) that the commercially available glucose-coated magnetic nanoparticles accumulated in U937 cell lines prior to application of magnetic pulses and shown no adverse effects on cell viability. Our investigations explored the possibility of increase cell death while concurrently increasing accumulation of doxorubicin via application of inhomogeneous magnetic fields assisted by magnetic particles.

User end station development at ELI-ALPS research facility/Hungary

The Extreme Light Infrastructure Attosecond Light Pulse Source (ELI-ALPS) located in Europe is a large-scale ultrafast user facility. Our team, the Ultrafast Dynamics group at ELI-ALPS serves international users' needs in ultrafast pump probe experiments. Our research focuses on ultrafast dynamical processes in the gas phase and in the condense phase. E.g. The group aims at investigating experimentally the impact of the intense and slow 'quasi static' terahertz (THz) electric fields on chemical reactions and exciton dynamics. The THz will play a role in aligning molecules (*Phys. Rev. Lett.*, **2011** 107, 163603) and manipulating polarizable electronic states (*JPCA*, **2012**, 116, 11228) for controlling outcome in simple chemical reactions such as in photodissociation reactions. For detection, we apply novel chemiluminescence based time resolved Fourier Transform Visible Spectroscopy (FTVIS), which is a relatively new methodology explore energy disposal from photodissociation of small molecules (*JPCA* **2020**, 124, 14, 2755–2767). Photodissociation is initiated by intense IR femtosecond pulses/attosecond/XUV pulses and allows to obtain detailed chemical information such as the presence of neutral fragments in Coulomb explosion experiments.

In parallel to the gas phase experiments, our transient absorption spectroscopic apparatus investigates ultrafast dynamics in the condense phase. Our current research aims at addressing questions how transient absorption spectroscopic methodology can provide in situ ultrafast experimental data at elevated temperatures on colloidal nanoparticle systems. We are currently investigating the acoustic vibrational modes of gold nanoparticles/nanorods during high temperature growth and the ionization of doped semiconductor quantum dots (Ga,In,Sn CdSe/ZnS) with the help of in situ transient absorption technique.