

**Analysis of ultrafast dynamics in clusters and molecules
by pump-probe spectroscopy and by optimal control**

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The following topics will be addressed and illustrated on selected examples:

- How theory can provide conditions under which shaped laser pulses will produce ultracold molecules (e.g. Rb₂)
- Time scales of different processes deduced from adiabatic and nonadiabatic dynamics and from simulated pump-probe signals.
 - i) influence of size effects on dynamics in excited states of anionic gold clusters: from oscillatory wavepacket motion to photoinduced melting;
 - ii) isomerization and IVR in noble metal oxide clusters
- The role of IVR and its control in context of chemical reactivity of noble metal clusters (gold versus silver)
- New strategy for optimal control of infrared processes in complex systems driving isomerization in rigid and floppy systems

Analysis and control of ultrafast dynamics in complex systems is based on combination of quantum chemical MD “on the fly” with Wigner distribution approach.