Nonlinear Optics
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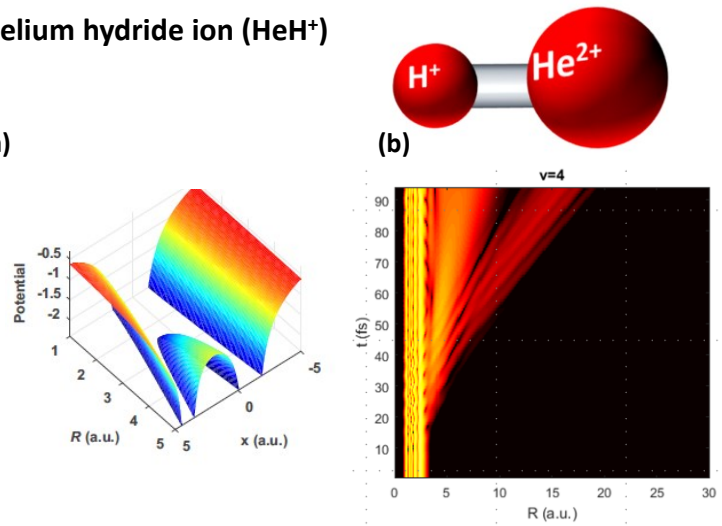
Bachelor or Master Thesis:

Sub-cycle fragmentation dynamics of HeH^+

In the group Nonlinear Optics at the IOQ we perform experiments to investigate the ionization dynamics of atomic and molecular ions in ultrashort laser pulses. The use of ions gives access to fundamental systems of laser-matter interaction and allows the observation of fundamental quantum mechanical processes on the femto- and attosecond time scale.
The **aim** of this thesis is to study the sub-cycle dynamics of the dissociation and ionization of the Helium hydride ion(HeH^+) isotopologues experimentally and theoretically. The HeH^+ continues to intrigue researchers as the first molecular species to arise in the universe and has mysteriously remained absent in astronomical spectra for a long time. In addition, HeH^+ is a particularly attractive molecule for investigating the sub-cycle dynamics of elementary photochemical processes because of its lack of symmetry, a property shared with few-cycle pulses.

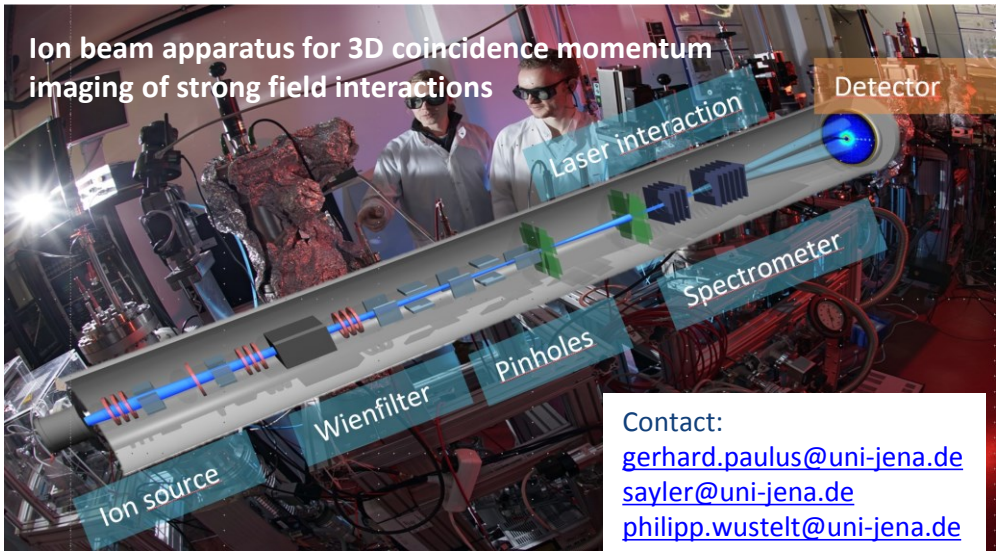
Helium hydride ion (HeH^+)



(a) Potential of the HeH^+- molecule (b)TDSE-Simulation of HeH^+ as-dissociation in a fs-pulse

Objectives:

- Characterization of few-cycle and two-color laser pulses
- Strong field laser experiments with ion beams
- Quantum-mechanical or semi-classical simulations of molecular dynamics



Literature:
Rathje et al., *Phys. Rev. Lett*. **111**, 093002 (2013)
Wustelt et al.,*Phys. Rev. Lett.* **121**, 073203 (2018)

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