Ultrakurze Laserpulse und Starkfeld-Physik

AGs Morgner / Kovacev
Institut für Quantenoptik

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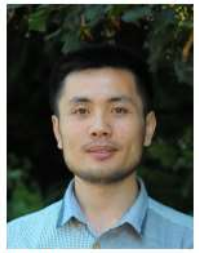

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Jan Heine


Jose Mapa


Nived Johny


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Zulqarnain

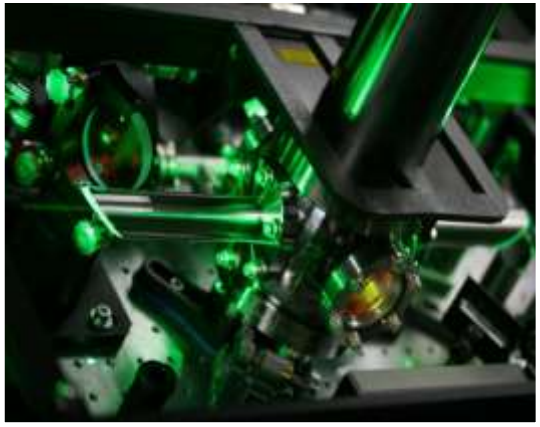

Jonathan Misslisch

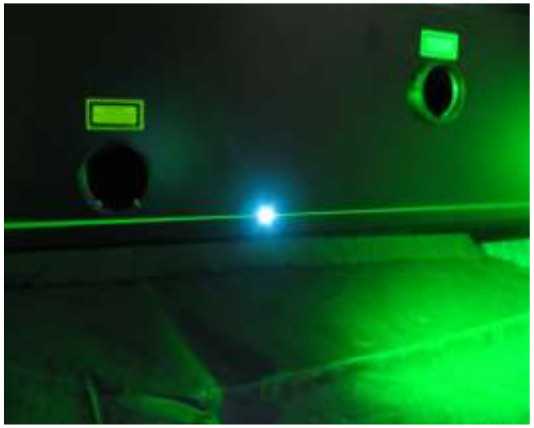
Kooperationspartner:

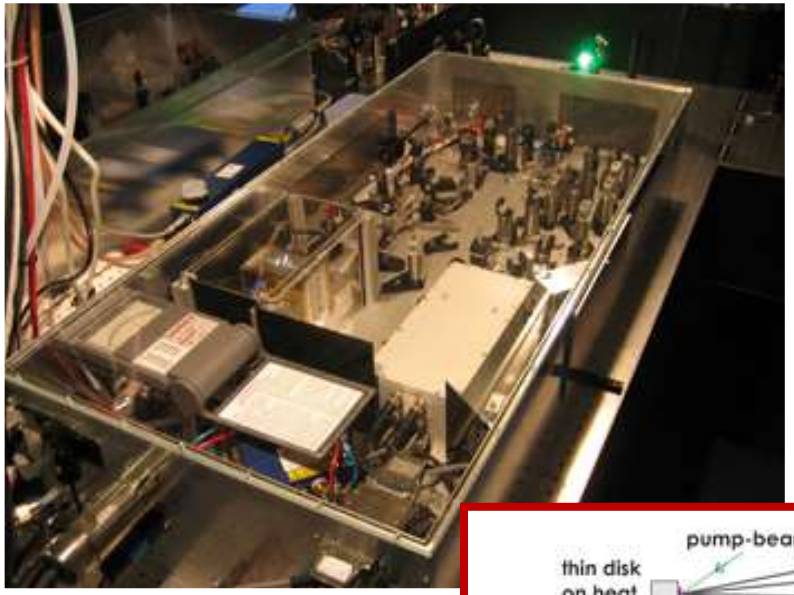
Inhalt

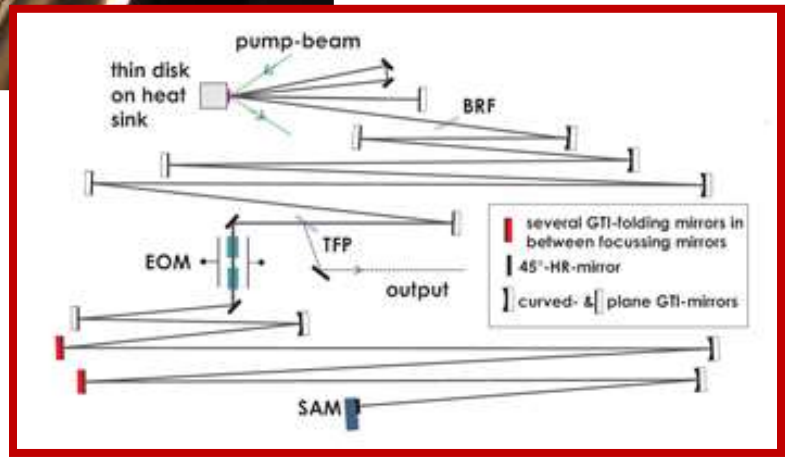
- Forschungsthemen für eine Bachelor-Arbeit
  - Laserentwicklung / Ultrakurze Laserpulse
  - Starkfeld-Physik
  - Computational Photonics
    - Nanophotonics
    - Hochleistungs OPA
    - Free-Electron-Laser FLASH II (DESY Hamburg)
    - Filamentation
    - Water Droplet Interaction

Laserentwicklung / Ultrakurze Laserpulse









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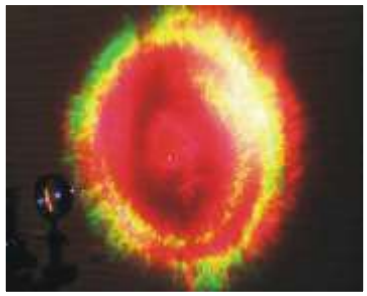
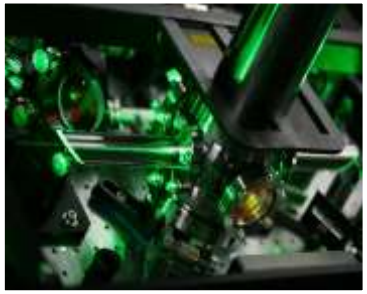
http://www.iqo.uni-hannover.de/ultrafastlaseroptics.html

Starkfeld-Physik

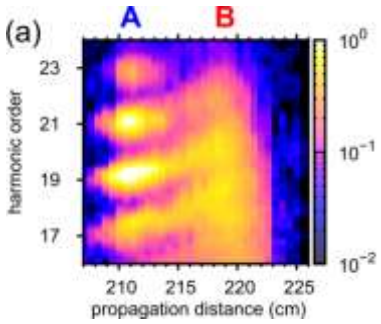


Nichtlineare Optik
~ 10^{15} W cm^{-2}

http://www.iqo.uni-hannover.de/ultrafastlaseroptics.html



Laser Design (Oszillatoren, Verstärker, Faserlaser)



Erzeugung kohärenter Röntgenstrahlung (Attosekundenpulse 10^{-18}s)

Bildgebung mit kohärenter Röntgenstrahlung

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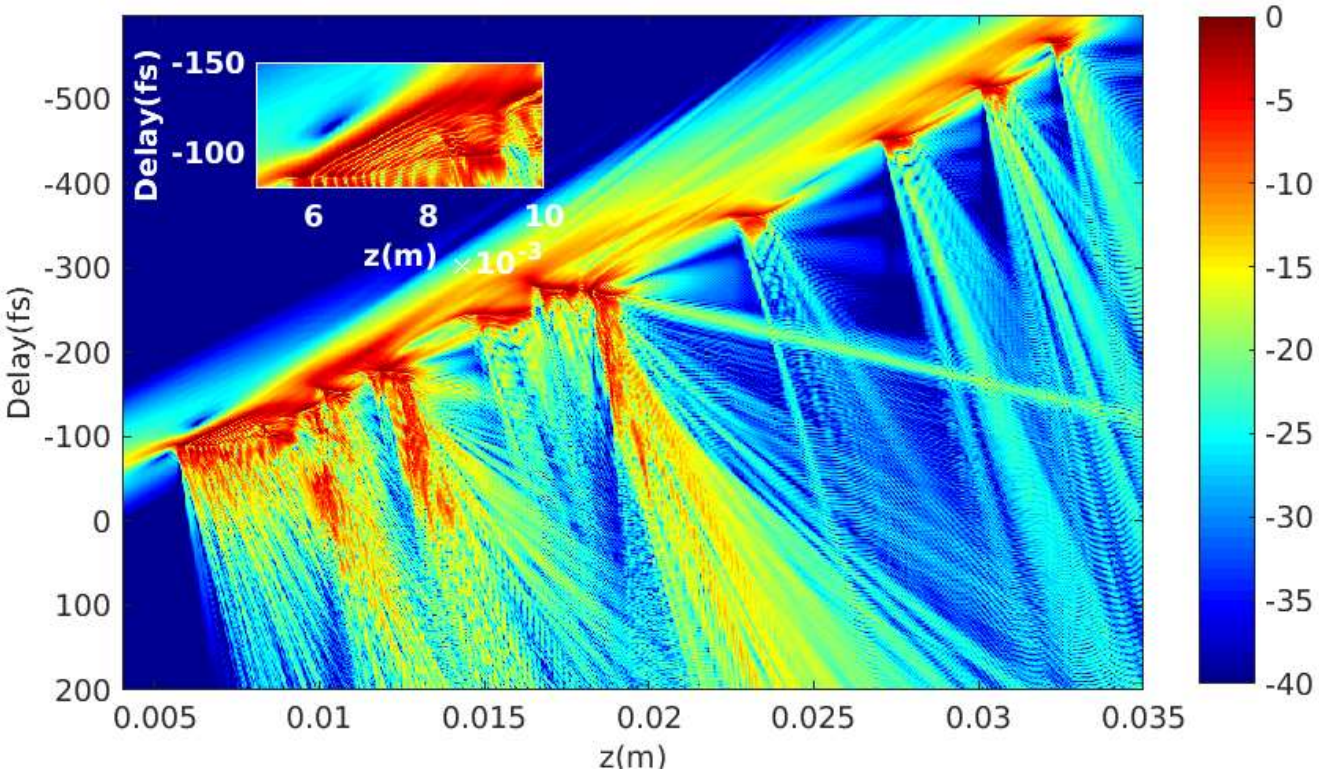
Computational Photonics

Propagation of a light bullet in glass slightly below the damage threshold



- Few-cycle optical pulse propagation
- All-optical control
- Strong field light matter interaction

Nanophotonics

Ti:Sapphire oscillator
270-400 mW, 5 nJ,
5-15fs, 825nm, 80 MHz

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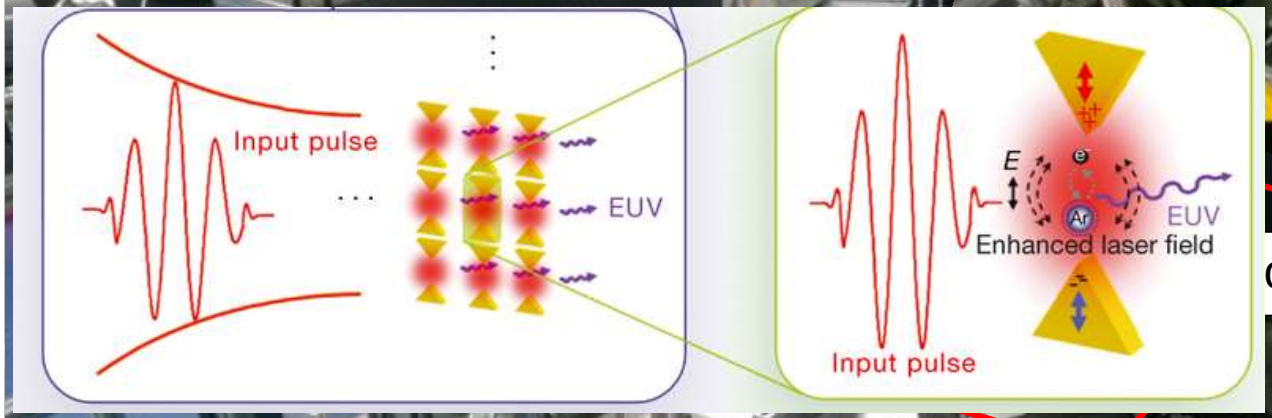
Sample chamber
& XUV spectrometer

Dispersion
management

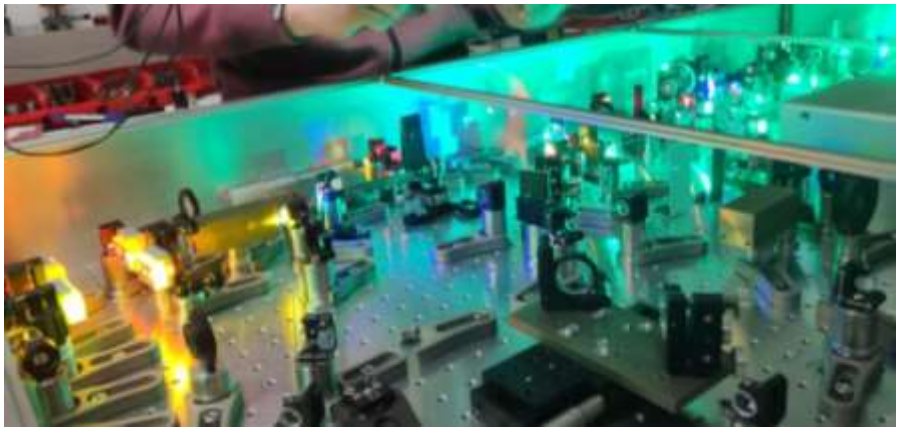


ope setup

→ X-ray microscopy through diffractive imaging

Zeitliche Stabilisierung eines Hochleistungs-OPAs

- Optisch Parametrische Verstärker (OPAs) sind die perfekte Wahl bei Verstärkung ultrakurzer (<10fs) Laserpulsen bei hohen Ausgangsleistungen
- Parametrische Verstärkung funktioniert nur, wenn Pumppuls und zu verstärkender Puls gleichzeitig im Verstärkerkristall ankommen



Ansprechpartner:
David Zuber
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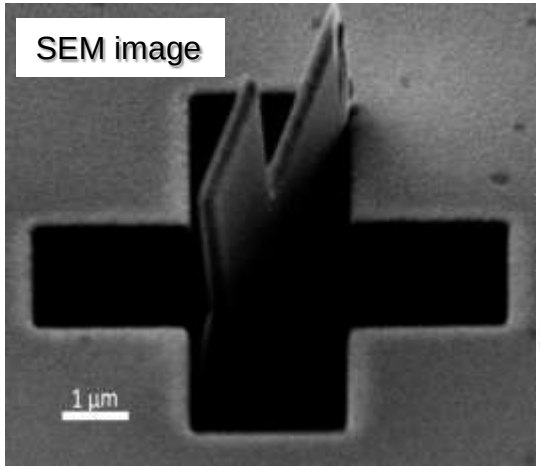
- Ziel der Bachelorarbeit ist der Bau einer entsprechenden zeitliche Stabilisierung
- Arbeit beinhaltet optische und elektronische Aufbauten sowie Softwareentwicklung
- Kentnisse in nichtlinearer Optik und Ultrakurzpulsoptik benötigt, Programierkentnisse sind hilfreich

Two stereo views with X-rays in transmission

Far-field snapshots from *Coherent Diffractive Imaging*

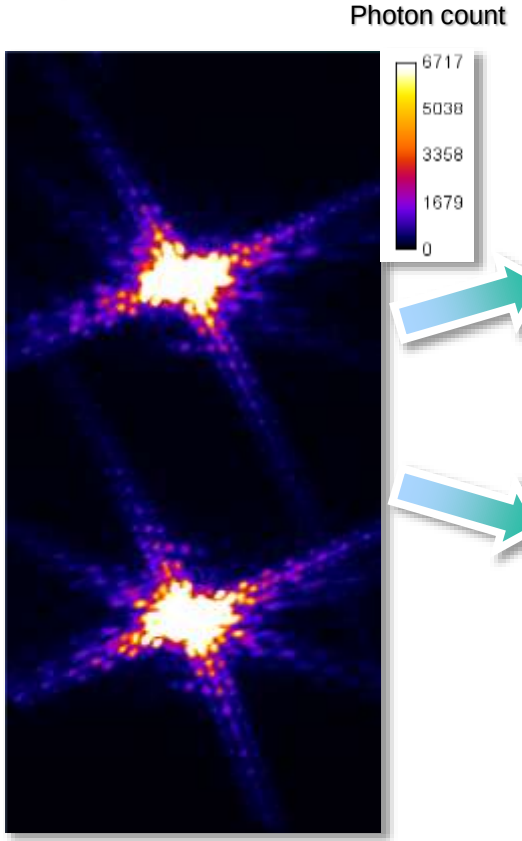
Object



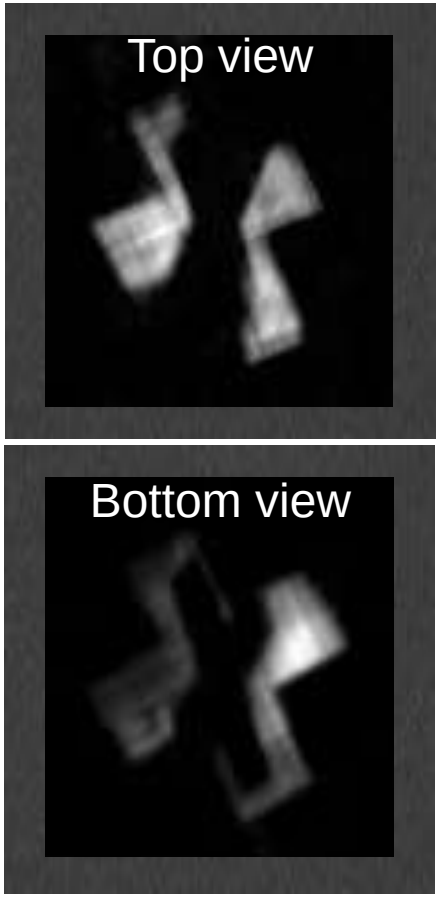
Single-shot diffraction patterns

Beam @ +9,5°

Beam @ -9,5°



CDI reconstructions




nature photonics

Article | Published: 15 April 2019

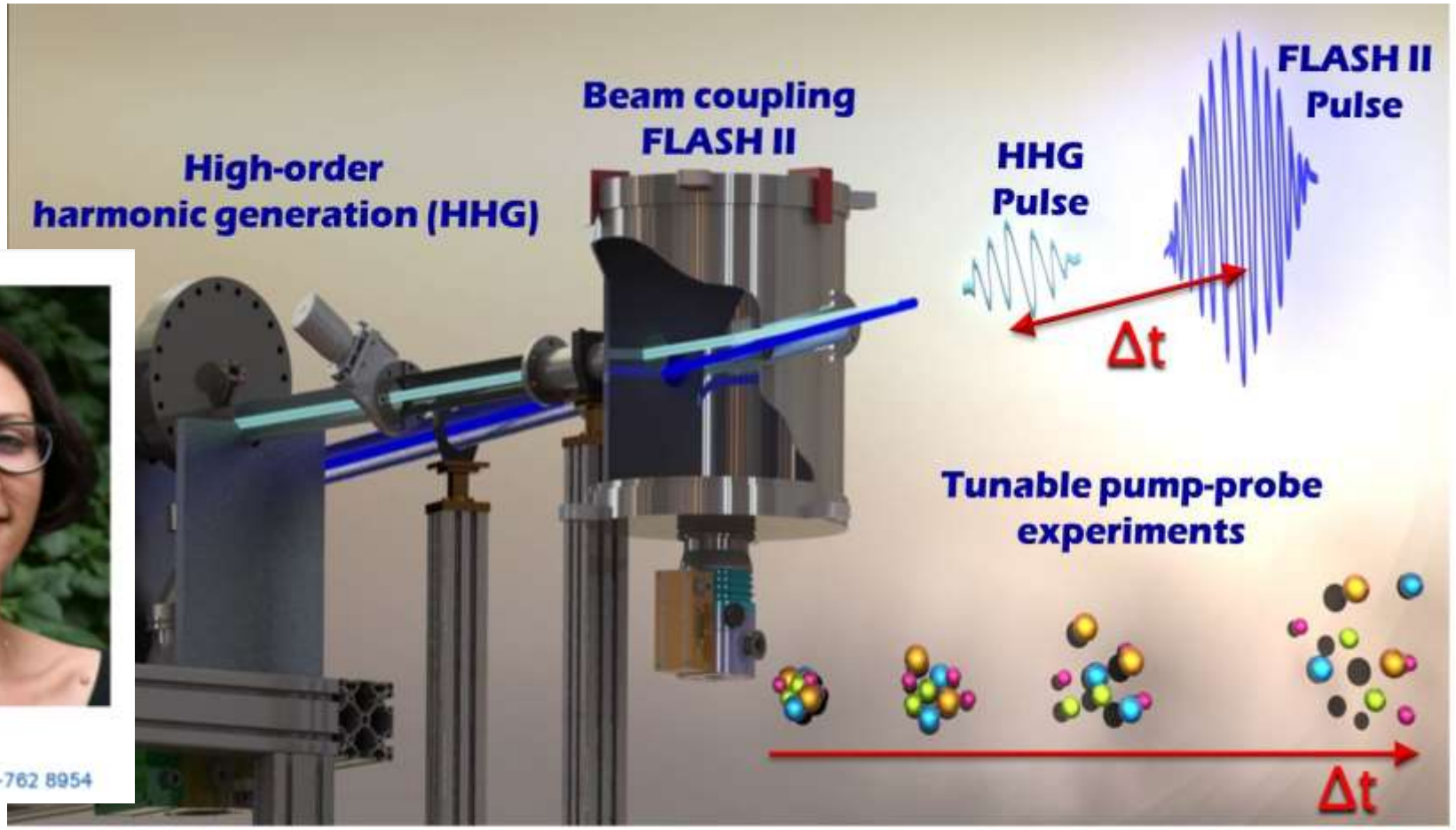
Computed stereo lensless X-ray imaging

J. Duarte, R. Cassin, J. Huijts, B. Iwan, F. Fortuna, L. Delbecq, H. Chapman, M. Fajardo, M. Kovacev, W. Boutu & H. Merdji

Nature Photonics 13, 449–453(2019) | Cite this article

2620 Accesses | 89 Altmetric | Metrics

FLASH II Beamline – VUV/FEL spectroscopy



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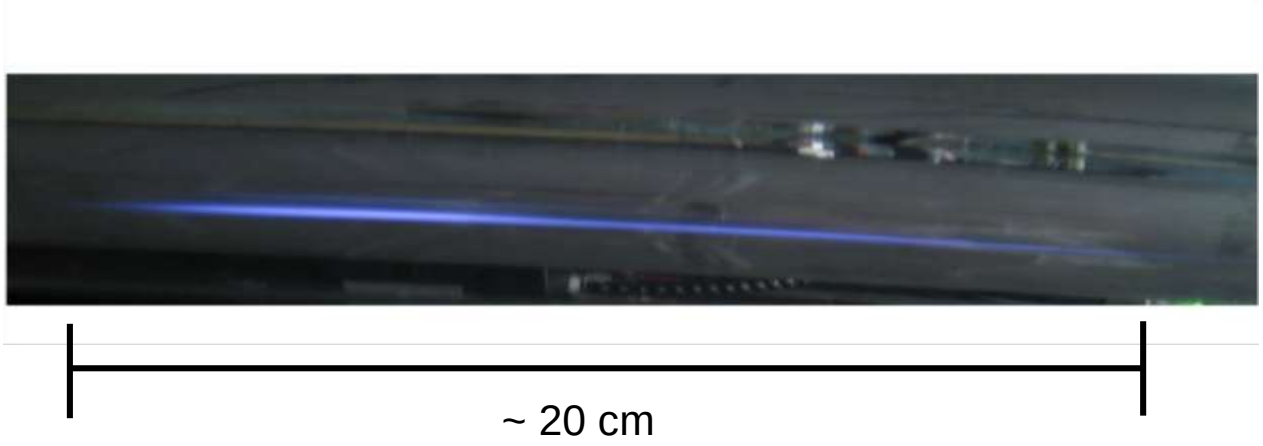
Broadband-tunable VUV pulses prepare the target state by one-photon excitation

Filamentation



$$P_{cr} = \frac{3{,}77}{8\pi}\frac{\lambda^2}{n_0 n_2}$$

- Nonlinear propagation regime (Self-action-effects)
- Long distance propagation (>typ. diffraction length)
- Continuous plasma channel

Christoph Jusko
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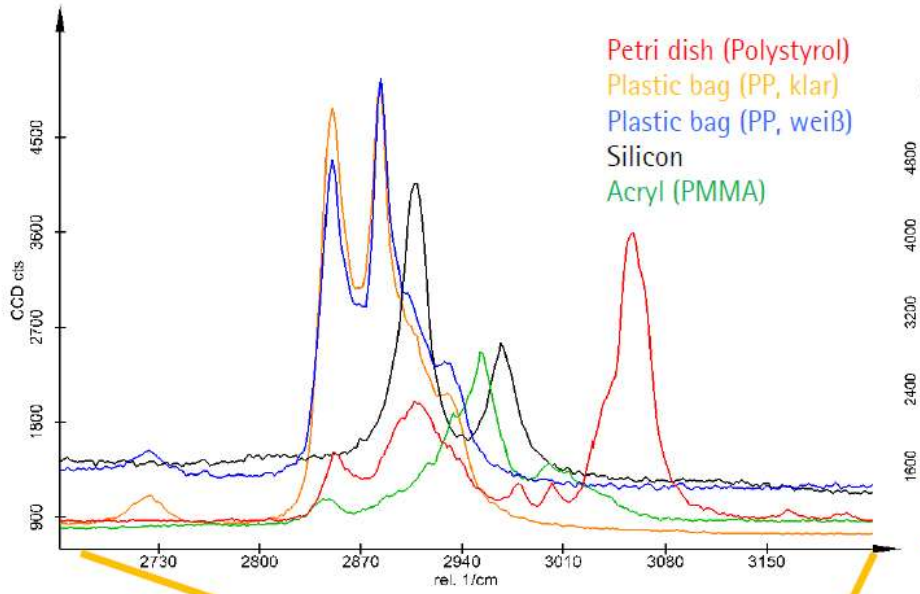
Temporal dynamics

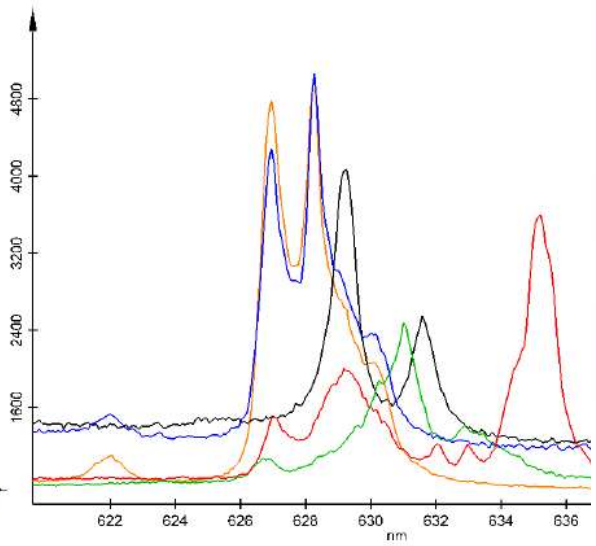
- SPM, SCG, splitting, shortening, spiking, …

Spatial dynamics

- SF, conical emission, multiple filamentation, …

Detektion von Mikroplastik in Wasser





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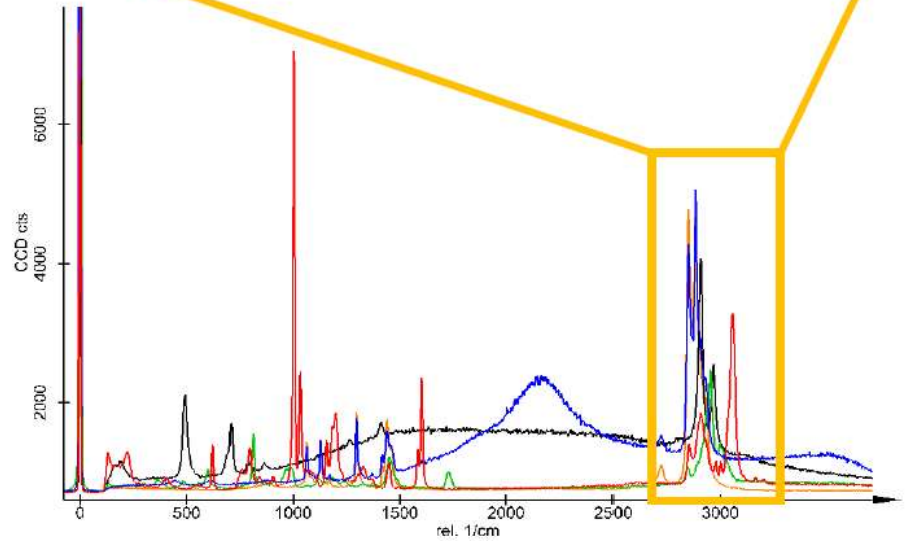
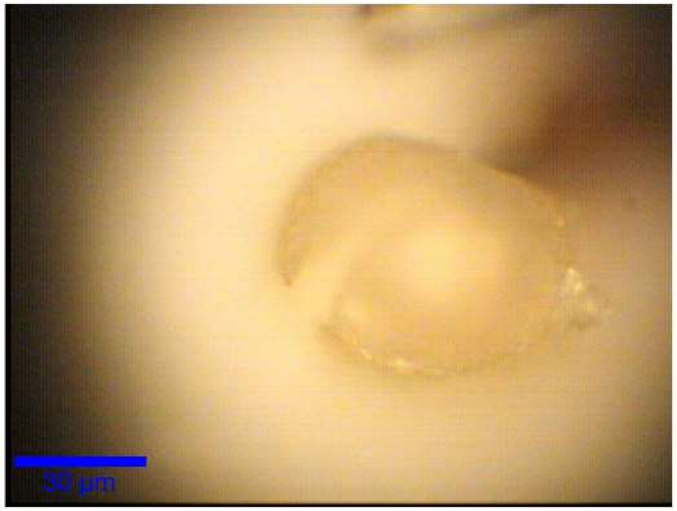
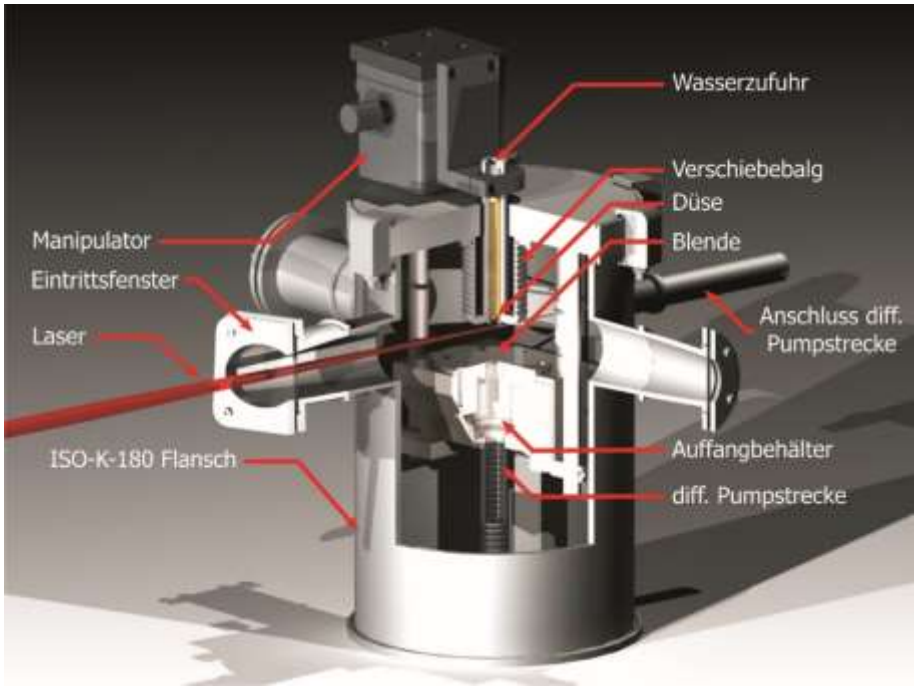




Water Droplet Interaction



- **Tröpfchenmode**

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