Materials ablation with ns, ps and fs XUV laser pulses

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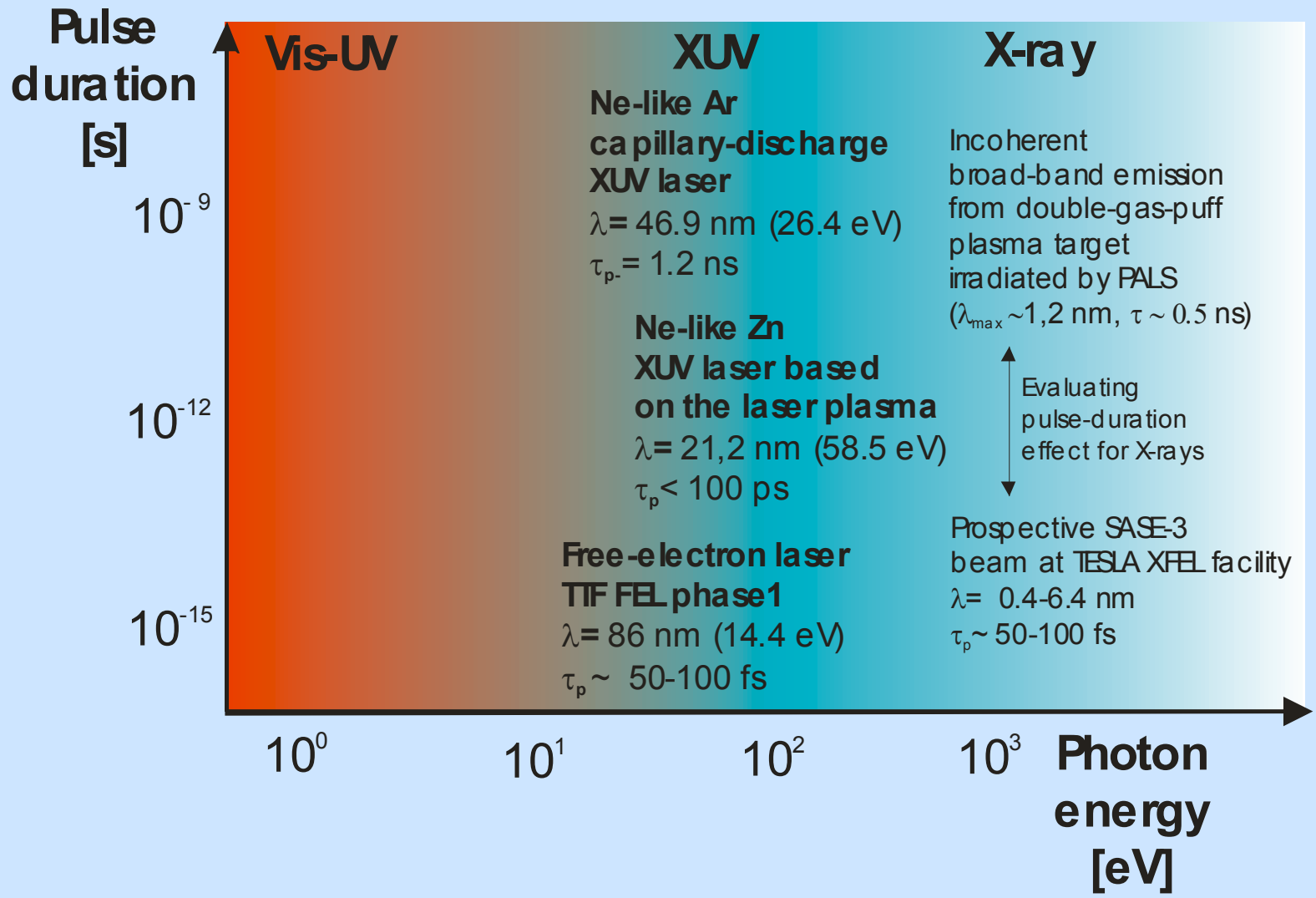
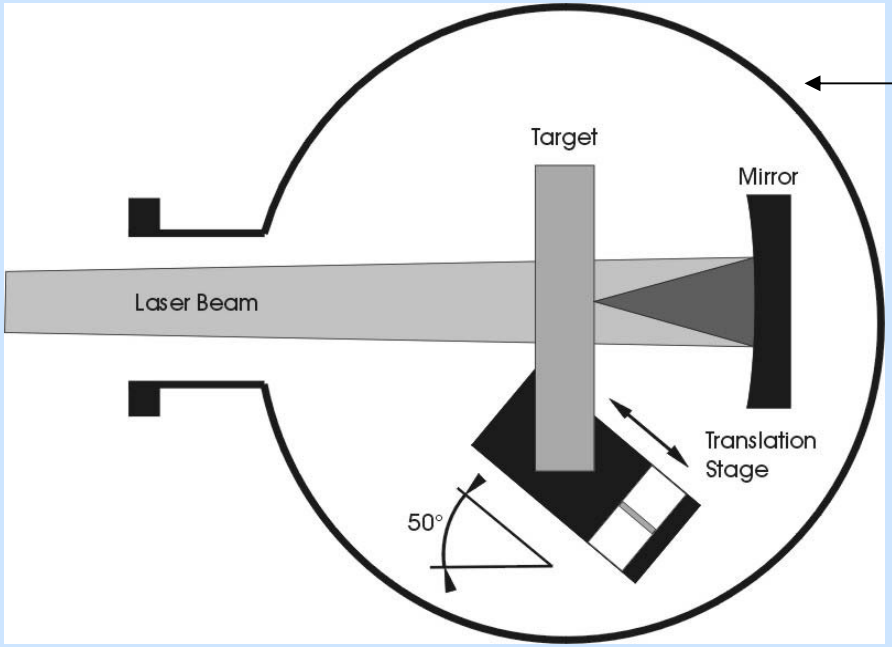


- influence of particular properties of XUV laser radiation on XUV ablation
  - evaluating thermal and nonthermal effects in the XUV ablation

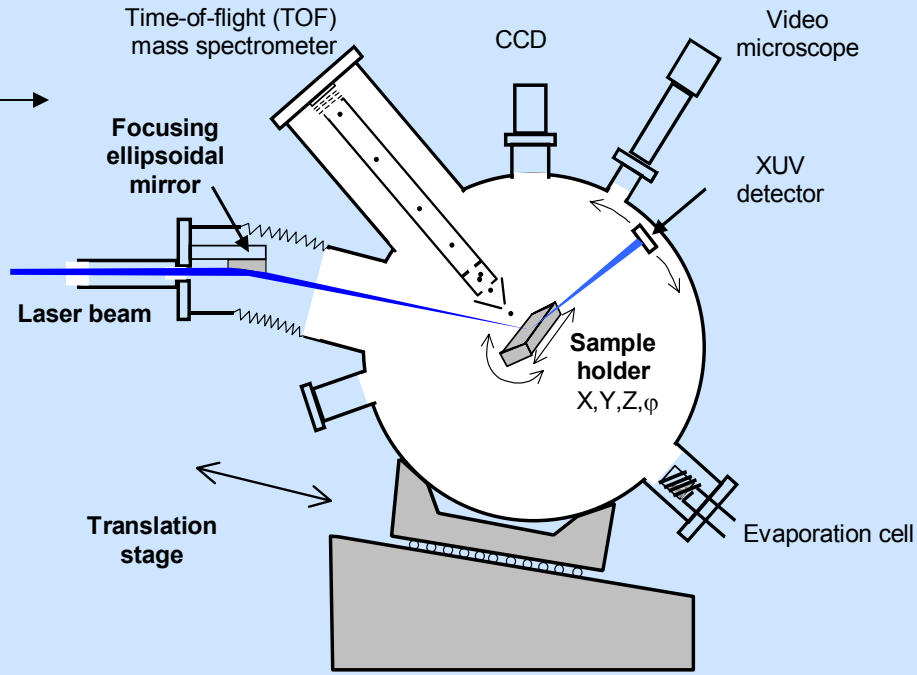


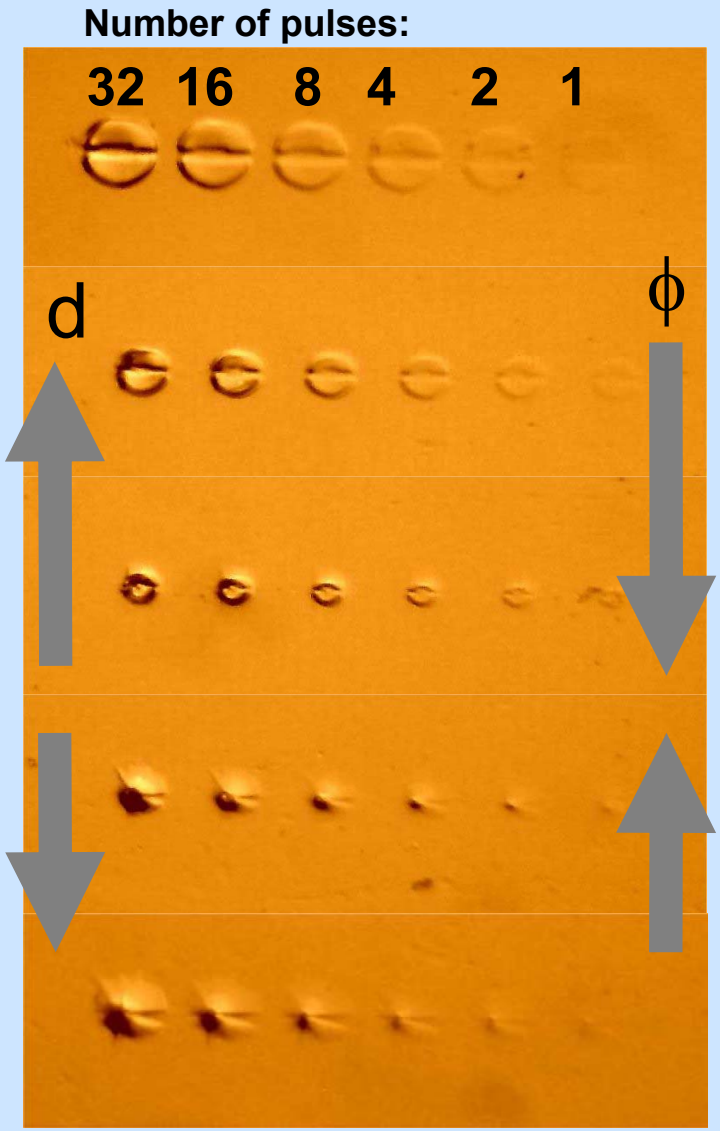
Focusing of the Ne-like Ar laser beam:

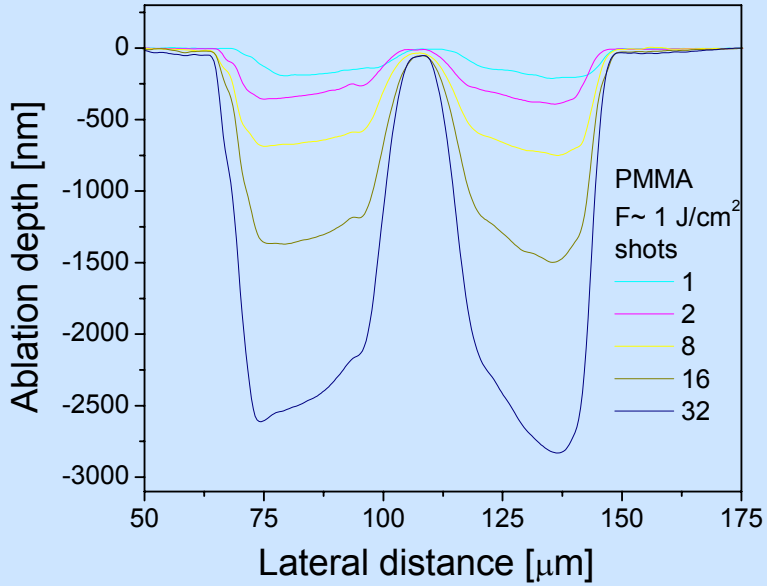
- on-axis layout with a spherical multilayer mirror
- sample holder affects the beam before focusation

Focusing and interaction of the FEL beam:

- grazing-incidence ellipsoidal mirror fixed with respect to the beam
- fluence variations due to the movement of the whole interaction chamber with respect to the focus

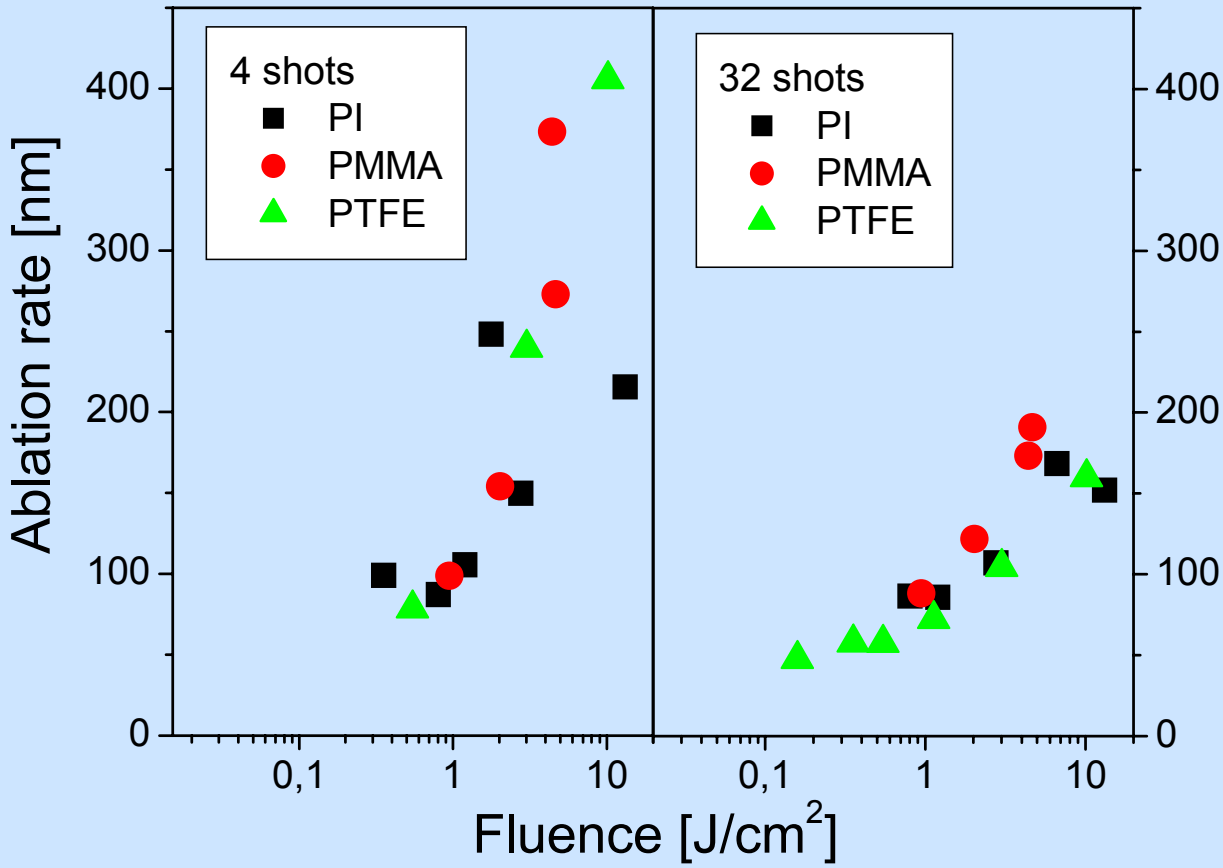






Ablation of PMMA by 46.9 nm XUV laser

- microphotography of ablated craters: number of accumulated pulses varied horizontally; fluence ϕ was varied by changing the sample position with respect to the focus
- profiles of craters ablated by increasing the number of pulses accumulated at a fixed fluence



• demonstrating close efficiencies of ablation induced by 46,9-nm radiation in PMMA, PTFE, and PI (unlike the ablation in UV-Vis region)

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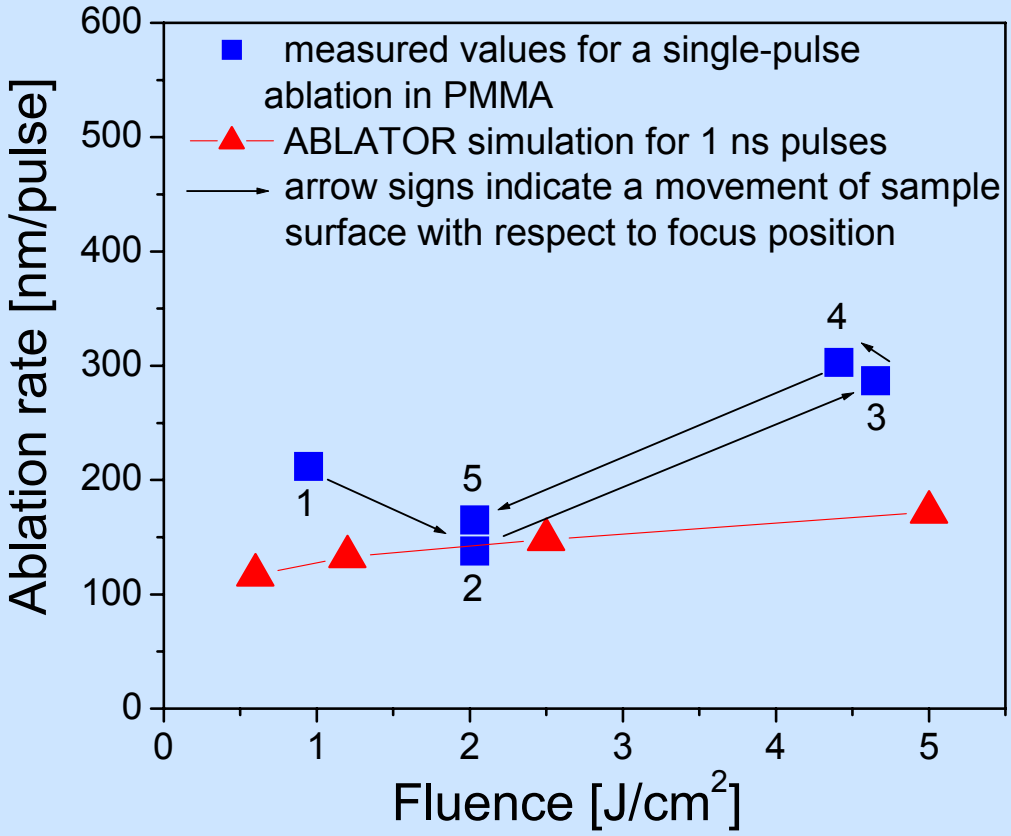
• attenuation lengths at 46.9 nm: PMMA 19 nm, PI 16 nm, and PTFE 12 nm



Testing the numerical code ABLATOR [A. T. Anderson: PhD Thesis, UC-Berkeley 1996] modified for a prediction of XUV ablation in PMMA

• thermal vaporization is still considered to be a key process

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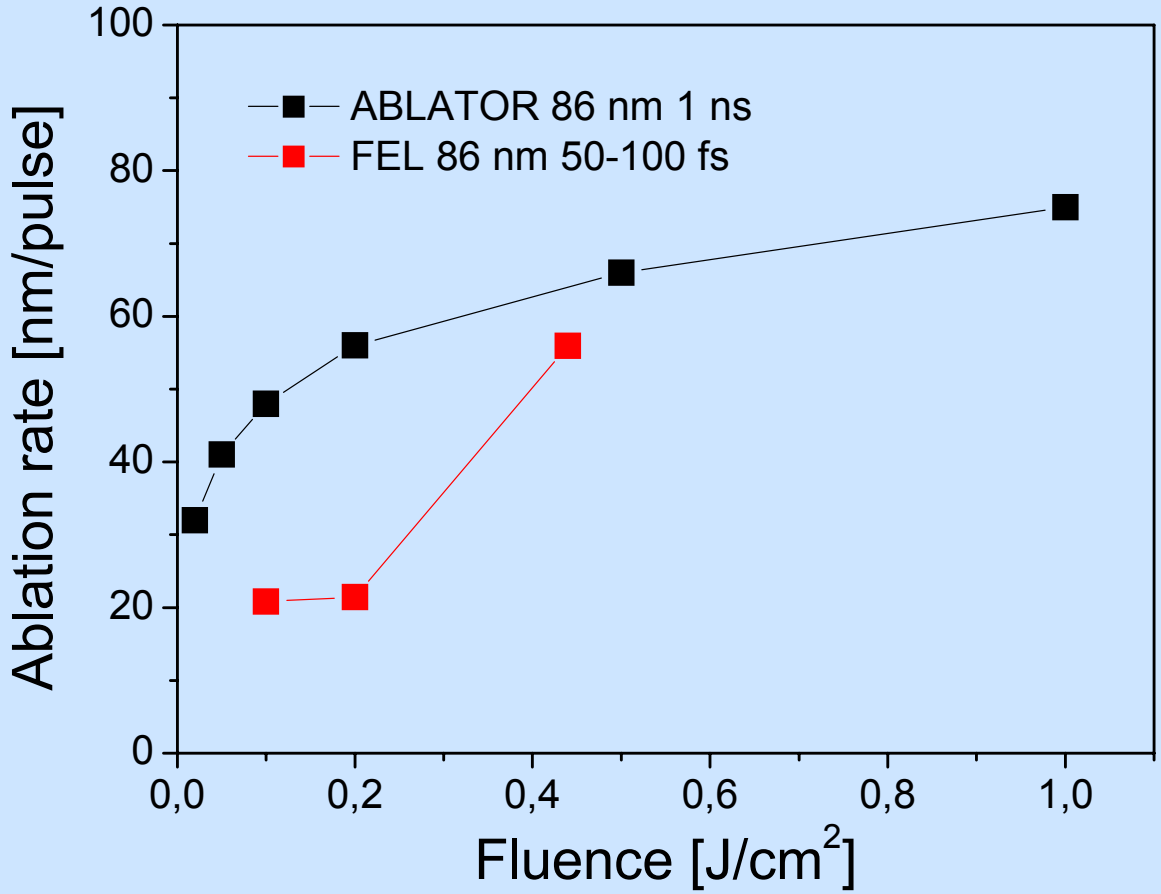
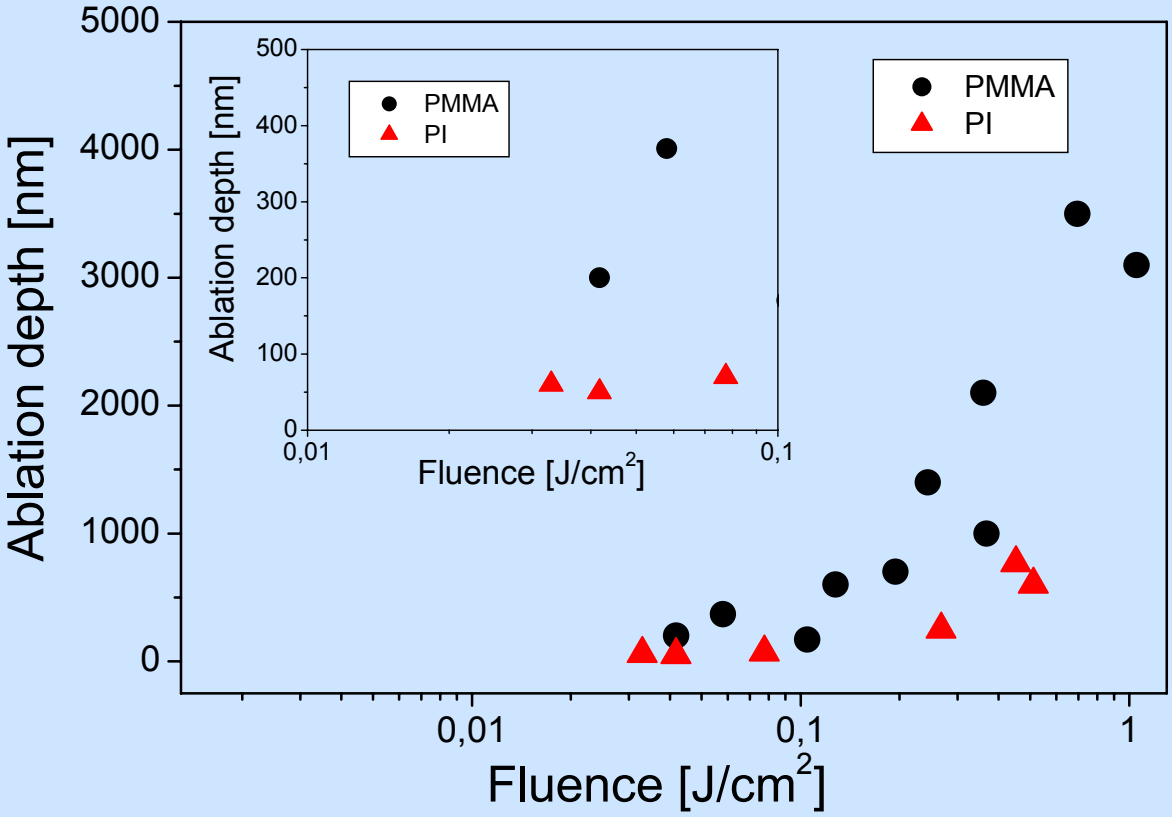
• more substantial decomposition of PMMA by XUV photons should be taken into account



• comparing PMMA ablation for ns and fs 86-nm laser pulses
ns pulses are not available in the lab - ABLATOR calculation

low sensitivity to pulse duration ⟷ nonthermal processes play a role



• ablation of PMMA and PI induced by incoherent 1-keV radiation emitted from Xe@He gas-puff target irradiated with 0.5-kJ pulses from PALS

attenuation lengths at 1.24 nm: PMMA 3.0 μm and PI 2.5 μm

• AFM image of rim of the crater produced in PMMA by tightly focused 86-nm FEL radiation; spatial period is 69 nm for the observed LIPSS

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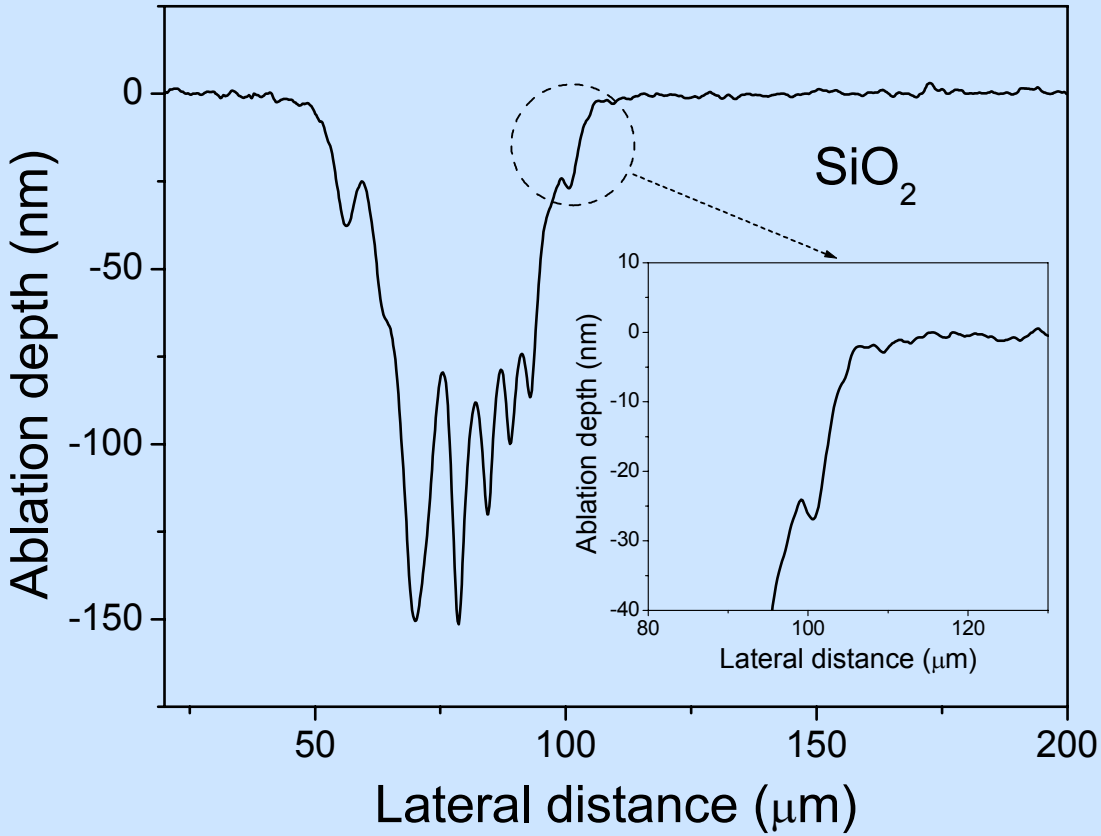
• the period is related to the laser wavelength → LIPSS-I formed due to the interference of the incident laser beam with a wave diffracted by periodic features in the materials



fs-XUV ablation of inorganic insulator

• monocrystalline quartz ablated by 86-nm FEL radiation; a periodic shaping of the crater bottom appeared due to diffraction on Au wire used for pulse energy measurement