Wavelength dependence of single-shot laser ablation thresholds for semiconductors

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In single-shot ultra-short pulse laser ablation of dielectrics, strong field ionization (SFI) plays a crucial role. SFI is often modelled using Keldysh theory [1, 2]. SFI likely also plays a similarly important role in wide-bandgap semiconductors, like SiC and GaP. This can be tested by investigating he wavelength dependence of measures like the ablation threshold.
The experimental work that has been done on the wavelength dependence of ablation thresholds on semiconductors remains very limited however. Several publications only use the fundamental and a few higher harmonics of a laser to vary the wavelength [3, 4]. Other work does use more wavelengths, but ends up with very few data points for the thresholds [5]. More work has been done on the wavelength dependence of ablation thresholds for dielectrics [2, 6], but the amount of research on this subject focused on semiconductors remains very limited.
We have developed an experimental setup for ablation studies, based on [7], which incorporates a femtosecond laser with an optical parametric amplifier. This setup allows us to do single shot ultrafast laser ablation experiments where we create large numbers of ablation sites at many different wavelengths.
In this work, we investigate the wavelength dependence of ablation thresholds for several semiconductors. More specifically, we investigate the wavelength ranges around the transition from N to N+1 photon absorption for these materials.

References:

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