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Gas media characterization for efficient high-order harmonic generation

Pulsed gas nozzles are widely used in molecular and atomic physics to prepare gaseous samples for light-matter interactions. The expansion behavior and density distribution of the released gas is difficult to determine, however of particular interest. The gas density is, e. g., one of the crucial parameters for the conversion efficiency and phase matching properties of high-order harmonic generation (HHG). We present our results on the time-resolved characterization of an argon gas expansion released into vacuum via different gas medium geometries. Hereby, we complement the results obtained through an interferometric setup with the technique of Schlieren photography.

A piezo-driven pulsed gas medium releases argon gas into a high vacuum chamber via different cell and slit geometries. We use an interferometric setup to determine the pressure distribution of the released gas in a plane perpendicular to the expansion. By varying the time delay between the pulsed valve and the acquisition camera, we are able to resolve the expansion as a function of time. The interferometric results are complemented with measurements obtained via Schlieren photography. This method allows to reconstruct the spatial shape of the gas expansion with high sensitivity based on refraction and underlines the interferometric results. However, this does not give quantitative access to the pressure. By combining both techniques we were able to characterize the gas density profile with high spatial and temporal resolution.

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