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Plasma Characteristics in Liquid Jets via Supercontinuum light

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Introduction. Investigating plasma behavior within liquid jets via supercontinuum light probe presents a compelling frontier in understanding the physics behind the plasma effects. The utilization of supercontinuum light as a probe offers an opportunity to delve into the intricate mechanisms governing plasma relaxation, the recombination time, and the altering dynamics influenced by different wavelengths as well. This investigation is pivotal for enhancing our comprehension of plasma physics within liquid jets, particularly considering their potential as potent radiation sources for terahertz signals [1,2]. In an era where advancements in plasma technologies are increasingly vital for various industries, unraveling the complexities of plasma behavior in liquid jets stands as a pertinent pursuit for scientific inquiry [3].

Body. This study investigates the mechanisms influencing plasma formation in liquid jets through time-resolved experiments employing a double-pump configuration. Supercontinuum light is generated by focusing an 800 nm wavelength pump beam onto a quartz plate, subsequently used as a probe directed towards the plasma. The method relies on analyzing supercontinuum pulses post-interaction with plasma.

By examining the transmitted supercontinuum, plasma behavior across various wavelengths is observed. The experimental setup features an isopropyl liquid jet plane with a thickness of 100 micrometers. Measurements are conducted during plasma formation in both the liquid jet and in air without the liquid jet, facilitating an assessment of the liquid medium's impact on results.

The acquired data depicts plasma dynamics, by the dependence of transmitted wavelengths of supercontinuum on the time delay between double pump pulses. These findings elucidate plasma relaxation behavior for each wavelength, offering insights into factors governing recombination time and plasma degradation.

Additionally, a theoretical model is developed to estimate plasma refractive index based on plasma absorption of transmitted signals. This modeling effort is essential for estimating various properties, including recombination time, providing a comprehensive theoretical framework for interpreting experimental observations.

Conclusion. The obtained results shed light on plasma dynamics within liquid jets, revealing insights into recombination time and plasma degradation mechanisms. These findings pave the way for advancements in plasma physics research, with potential applications spanning from Terahertz signal generation to advanced materials processing.

List of sources used:

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