Bulletin of the American Physical Society

52nd Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics
Monday–Friday, May 31–June 4 2021; Virtual; Time Zone: Central Daylight Time, USA

Session C03: Ultrafast and strong-field dynamics in the condensed phase
10:30 AM–12:30 PM, Tuesday, June 1, 2021

Chair: Robert Baker, Ohio State University

Abstract: C03.00008 : Wavelength scaling of electron collision times in filament-produced plasma in solids *

11:54 AM–12:06 PM Live

← Abstract →

Presenter:
GARIMA C NAGAR
(Binghamton University)

Authors:
GARIMA C NAGAR
(Binghamton University)

Dennis Dempsey
(Binghamton University)

Bonggu Shim
(Binghamton University)

We report an anomalous regime of laser-matter interactions, which is created by the wavelength dependence of electron collision time during filamentation in solids. Experiments are performed using femtosecond-time-resolved interferometry by varying the filament driver wavelength from 1.2 to 2.3 μm and using a 0.8-μm probe. Information on the phase and absorption via interferometry enables simultaneous measurements of plasma densities and electron collision times during filamentation. Although it is expected that the plasma density decreases with increasing wavelength due to larger plasma-defocusing at longer wavelengths [1-4], our measured plasma densities are nearly constant for all the pump wavelengths. This observation is successfully explained by the measured wavelength-dependence of electron collision time: electron collision times in filament-produced plasma decrease with increasing wavelength, which creates an anomalous regime of plasma-defocusing where longer wavelengths experience smaller plasma defocusing. In addition, simulations with the measured electron collision times successfully reproduce the observed plasma density scaling with wavelength [5]. [1] L. Bergé et al., Phys. Rev. A 88, 023816 (2013). [2] Y. E. Geints et al., Appl. Opt. 56, 1397 (2017). [3] S. Tochitsky et al., Nat. Photonics 13, 41 (2019). [4] R. I. Grynko et al., Phys. Rev. A 98, 023844 (2018). [5] Nagar et al., submitted.

*Funded by the National Science Foundation (NSF) (Grant No. PHY- 2010365), U.S. Air Force Office of Scientific Research (AFOSR) (Grant No. FA9550-18-1- 0223).