New approaches to characterize the properties of femtosecond laser filament

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Formation of femtosecond laser filamentation is mainly induced by the dynamic balance between nonlinear self-focusing and plasma defocusing effect. Its potential application in lightning control and remote sensing is closely related to the properties of filamentation, which makes it important to characterize them. For example, much effort has been paid on diagnostics of the laser intensity and electron density in filament using electrical conductivity measurement, quantitative fluorescence emission measurement and transverse or longitudinal interferometry, etc. In this contribution, we present two new approaches to measure the properties of filament. Firstly, laser intensity and its distribution has been quantified based on the dependence of sample ablation threshold on angle of incidence. Experimental results on laser ablation threshold of gold sample with angle of incidence have been presented. The peak intensity in filament is found to be strongly related to the external focusing of the laser beam. It is measured to be about 55TW/cm^2 in loose focusing which is in good agreement with previous work. Secondly, electron density and its temporal evolution have been studied based on a new single shot electromagnetic induction method. The transient magnetic field is detected by an induction coil and the current as well as electron density was estimated from the time dependent electromotive force signal. The experimental results show its advantages in obtain reliable temporal evolution of the electron density with reduced noise and interference compared with traditional electrical conductivity method.

Biography: Xiao-long Liu is an Associate Professor in Diode-pumped Laser Engineering Center in Academy of Opto-Electronics, Chinese Academy of Sciences, since 2012. From 2015 to 2016 he was a Visiting Scholar in College of Optical Sciences, The University of Arizona. He received his Ph.D. in Optics from Institute of Physics, Chinese Academy of Science in 2012. His research interests are as follows. First, nonlinear phenomena and their applications of filamentation generated by femtosecond laser pulse in transparent media. Second, fundamental research on ultrashort laser matter interaction and its application in laser micromachining and laser cleaning.

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