Generation of Terahertz Radiation by Beating of Dark Hollow Laser Beams in Magnetized Plasma

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Terahertz radiation (THz) generation has been a fascinating area of research for the last few decades due to its diverse applications in the characterization of electronic materials, chemical/ biological sensing, explosives detections, non destructive testing, astronomy and atmospheric research, short distance wireless communications, etc.There are several ways to generate THz radiation including the schemes of THz generation from semiconductors, nonlinear crystals via electro-optic crystal, photoconductive antennas via time-varying current, air plasmas through ponderomotive force, etc. [1-6].In the present work, we use laser–plasma interaction technique to generate focused and more efficient THz radiation.

In our work we have analytically calculated the electric field of the THz radiation and the efficiency of the scheme when two dark hollow laser beams beat in magnetized plasma. We have considered the electron neutral collisions in plasma. We employ dark hollow beam because it has same power at different beam orders. With the application of magnetic field, we can obtain two or more peaks in the THz field which would be quite useful for medical diagnostics. The effect of collision frequency and order of the dark hollow beams on the nonlinear current and amplitude of the emitted THz radiation are studied. By optimizing the laser parameters and externally applied magnetic field we could obtain the THz radiation with high intensity and amplitude.

References

[1]C. Zhang, Y. Avetisyan, A. Glosser, I. Kawayama, H. Murakami, M. Tonouchi, Optics Express **20**, 8784(2012).

[2] Y. C. Shen, P. C. Upadhyay, H. E. Beere, and E. H. Linfielda, A. G. Davies, I. S. Gregory, C. Baker, W. R.Tribe, and M. J. Evans, Appl. Phys. Lett. **85**, 164 (2004).

[3] H.K. Malik, Phys. Lett. A **379**, 2826(2015).

[4] C. Weiss, R. Wallenstein, and R. Beigang, Appl. Phys. Lett. **77**, 4160 (2000).

[5] D. Singh and H. K. Malik, Plasma Sources Sci. Technol. **24**, 045001 (2015).

[6] M. Singh and R.P. Sharma, EPL **101**, 25001 (2013).