



Harmonic Excitation in High-Power Microwave interaction with magnetized Plasma in RL-mode Geometry

^a Trishul Dhalia, ¹ Rohit Juneja, ¹ Laxman Goswami, ¹ Srimanta Maity and ¹ Amita Das

¹ Department of Physics, Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016
e-mail (speaker): ^a trishuldhalia@gmail.com

Harmonic generations with magnetized plasma provides a mechanism to obtain high-frequency Electromagnetic (EM) waves in a controlled manner [1,2] by using a low frequency incident EM pulse on an over-dense plasma medium. Generation of higher harmonics in the context of X and O mode configurations have been studied in [3]. It was shown that both even and odd harmonics frequency get excited in the bulk plasma medium[3] in these cases. In the present study we have carried out Particle – In – Cell simulations using EPOCH framework to show that harmonic generation also occurs in a configuration for which the external magnetic field is applied parallel to the EM wave propagation (i.e. RL mode geometry). In this case, however, there are certain differences. For instance, only odd harmonics are seen to be present when a linearly polarized wave is incident. In the case of circular polarization of the incident wave there is no excitation of harmonics. The harmonic generation is observed to maximize when the incident EM wave matches with the electron cyclotron frequency. We have also provided an analytical understanding of these observations in the limit of weak non-linearity.

References :

- [1] Dromey, Brendan, et al. "High harmonic generation in the relativistic limit." *Nature physics* 2.7 (2006): 456-459.
- [2] Ganeev, Rashid A., ed. *Plasma Harmonics*. CRC Press, 2014.
- [3] Maity, Srimanta, et al. "Harmonic generation in the interaction of laser with a magnetized overdense plasma." *Journal of Plasma Physics* 87.5 (2021).