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Seminar

Institute for Plasma Research

Title : Dual-Band Operation of Relativistic Backward Wave Oscillators with Gaussian like Output for Directed Energy Weaponry Applications

Speaker: Dr. Mumtaz Ali Ansari
Indian Institute of Technology (BHU),
Varanasi

Date : 8th September 2021 (Wednesday)

Time : 03.30 PM

Venue : Online - Join the talk:

https://meet.ipr.res.in/PDF_talk_Mumtaz_3rd_September21

Abstract :

The Relativistic BWOs are an O-type slow wave device based on Cerenkov synchronism which generally operates and generates TM_{0n} mode. The TM_{0n} output mode found a potential application in the field of linear accelerator, plasma heating, space propulsion but cannot be used for the potential applications in Defense and Military sectors as it has a null at bore sight and there is a chance that target will get missed. The Directed Energy Weaponry (DEWs) and Electronic Warfare (EWs) applications require Gaussian output as it has got a maximum at its center axis. The Gaussian radiation pattern is formed by the combination of 85 % of TE₁₁/HE₁₁ mode and 15 % of TM₁₁ mode. A mode converter is needed to convert the outputted TM₀₁ wave to TE₁₁ wave but it increases the overall length of the device which in turn reduces the overall efficiency of the device. So, there is a need of the devices that can directly generate TE₁₁ output mode with high efficiency. A two-way helically corrugated single fold cylindrical waveguide called the Bragg structure has been put forward which can perform multiple roles as an interaction circuit and reflector-cum-mode converter. However, the excitation of the asymmetric mode in the Bragg structure reduces the overall efficiency of the device.

In the present study, the design and simulation studies of the highly efficient dual-band RBWO using Bragg structure and non-uniform SWS is presented. Dual-band RBWO is studied by combining the nine periods C-band Bragg structure with the X-band non-uniform SWS for its beam-wave interaction. The concept of variable coupling impedance and less Bragg axial periods has enhanced the power conversion efficiency of the device and it's calculated as ~17 % and ~24 % in C- and X-band, respectively. It is also observed that the dual-band device can be worked as the single-band device depending upon the value of guiding magnetic field. Further, the frequency tuning ~2.5 % in C-band and ~6 % in X-band is observed by varying the separation length of drift sections Ldr1 and Ldr2 respectively.
