3D COMPUTER SIMULATION OF THE COHERENT RADIATION FORMATION IN MULTIWAVE ĆERENKOV GENERATOR

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Earlier (34th ICOPS-2007) we presented the results of computer simulation of the multiwave ćerenkov generator (MWĆG)[1,2] obtained by means of an axially symmetric numerical model. However, many physical processes accompanying the formation of coherent radiation remained unclear.

This paper presents the results of the full 3D modeling MWĆG held at the Russian supercomputer resources. The used code has been developed by us. It was based on the simultaneous solution of Maxwell's equations in space-time representation and the equations of motion of charged particles. The field equations were approximated by finite differences, a electron beam is simulated using the method of macroparticulates. The boundary conditions allow to take into account the real electromagnetic properties of the material which used for making the electrodynamic structure (ES) of the device. The CIC method has been modified to give an exact validity of the charge conservation law. This algorithm was implemented in parallel form. Total area was divided into parallelepiped blocks. One block had several common nodes of the spatial grid with neighboring blocks. The maximum number of neighbors is 26.

The developed algorithm was used to simulate the formation of coherent electromagnetic radiation in MWĆG. It was shown that during generation process the annular electron beam can be split into separate streams. The output radiation has a predominantly axially symmetric structure and fixed frequency, which corresponds to real experimental data.

Thus, the physical processes in MWĆG differ from the processes of traditional devices, in which the mode selection is significant.

The behavior of the system is an example of self-organization of the active medium.

1. Bugaev S.P., Cherepenin V.A., Kanavets V.I., Koshelev V.I., Popov V.A., Vlasov A.N. IEEE Transactons on Plasma Science,v.18, June 1990, N 3,. p.518-524.
2. Bugaev S.P., Cherepenin V.A., Kanavets V.I., Koshelev V.I., Klimov A.I., Kopenkin A.D., Popov V.A., Slepkov A.I.. IEEE Transactons on Plasma Science,v.18, June 1990, N 3,. p.525-536.