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QUASI-OPTICAL SIMULATIONS OF SECOND HARMONIC ECRH EXPERIMENT AT FREQUENCY OF 54.5 GHZ AT THE GDT SETUP *)

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Absorption of electromagnetic waves under electron cyclotron (EC) resonance conditions is widely used to heat high-temperature plasma in large-scale magnetic traps used for research in the field of controlled thermonuclear fusion (CTF). In most cases, these are traps of a toroidal configuration, but recently there has been a revival of interest in mirror traps. A new generation of mirror traps is under development in different countries [1-3], and this makes it urgent to develop EC heating methods for systems of this type.

For the first time, effective EC heating of dense plasma in a large-scale open trap was demonstrated at the end of 2013 at the GDT (gas-dynamic trap) installation at the Budker Institute of Nuclear Physics [4]. For the experiment, a fundamentally new heating scheme was developed, in which a wave beam was launched through the side surface of the plasma column, and then captured due to subtle refractive effects in an inhomogeneous plasma and absorbed at the fundamental harmonic of the extraordinary wave [5]. As a result, due to additional heating, it was possible to raise the electron temperature to a record value for this class of installations, ~1 KeV, and increase the flux of thermonuclear neutrons by 80% [6]. At the same time, the developed scheme imposed a number of restrictions on the plasma parameters and the magnetic configuration of the installation, and also provided weak possibilities for controlling the position of the energy deposition region. To solve some of these problems, another scheme was proposed at the GDT, where radiation is launched along the resonance surface, and heating occurs at the second harmonic of the extraordinary wave.

This talk will present the results of a quasi-optical simulations of a new second-harmonic heating scenario. Modeling makes it possible to take into account the mutual influence of energy dissipation and beam diffraction, which can be significant when the beam propagates along the absorbing layer [7].

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