comparison of ECR heating in the t-10 tokamak at first and second harmonics [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.018

1Dnestrovskij Yu.N., 1Danilov A.V., 1Dnestrovskij A.Yu., 1Klyuchnikov L.A., 1Lysenko S.E., 1Melnikov A.V., 1Nemets A.R., 1Nurgaliev M.R., 1Subbotin G.F., 1Soloviev N.A., 1Sushkov A.V., 2Sychugov D.Yu. and 1Cherkasov S.V.

1NRC ‘Kurchatov Institute’ Moscow, Russia, Dnestrovskiy\_YN@nrcki.ru
2Lomonosov MSU, Moscow, Russia, [sychugov@cs.msu.ru](file:///C%3A%5CUsers%5CLysenko%5CDocuments%5Cdnyn%5CZvenD19%5Csychugov%40cs.msu.ru)

In the T-10 tokamak, the results of plasma heating at the first and second electron cyclotron (EC) harmonics are very contrast. Using two transport models, the heating at both harmonics is analyzed. The standard (S) model was developed to describe heating at the first harmonic [1, 2], while the Modernized (M) model was used to describe heating at the second harmonic [3]. To analyze the heating at the second harmonic with the model (S), the inverse problem of determining the absorbed power *Qab* profile from the experimental electron temperature *Te* profile is solved. This allows us to determine both the absorbed power profile and the fraction of absorbed power with respect to the input power *QEC*: =*Qab*/*QEC*. Squares in Fig. 1 mark this fraction as a function of the chord averaged density*n* for shots with heating at the second harmonic. One can see that at low densities this fraction is small. In this case, the absorbed power profile is much flatter than expected from ray tracing calculations for EC waves. At high densities, we have ~1. For shots with heating at the first harmonic (circles in Fig. 1), =1. It is known that the optical plasma thickness (‘grayness’) is proportional to *n Te*. Figure 2 shows the experimental dependence for *pe*0=*n*0 *Te*0, where *n*0 and *Te*0 correspond to the central density and the electron temperature, on the chord averaged density‾*n* for shots with heating at the first (circles) and second (squares) harmonics. The horizontal line at *n*0*Te*0=10 divides the shots with heating at the second harmonic into two groups. We see that the shots lying above this line totally absorb the input power: for them η=1. Shots lying below this line only partly absorb the input power: for them <1. So, for‾*n* <3 (in 1019 m-3), heating at the first harmonic is radically differs from heating at the second harmonic. When ‾*n*>4, a cut-off occurs for the first harmonic. In the region 3<*n*<4, the results of experiments with heating at the first and second harmonics may be close to each other.

The work is supported by RFBR grant 20-07-00391.

Fig. 1. Fig. 2.

References

1. Alikaev V.V., et al. Sov. J. Plasma Phys. Rep. 1988. V. 14. P. 601
2. Dnestrovskij Yu.N., et al. Plasma Phys. Control. Fusion. 2007. V. 49. P. 1477
3. Dnestrovskij Yu.N., et al. Plasma Phys. Rep. 2019. V. 45. P. 207
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/AA-Dnestrovskiy.docx) [↑](#footnote-ref-1)