Transport models of plasma heating at the second electron-cyclotron harmonic in tokamaks and stellarators [[1]](#endnote-1)\*)

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Experiments with heating at the first and second EC harmonic at the T-10 tokamak allows us to find a criterion for the full microwave absorption [1] and to construct transport models (Standard for total absorption and Global for partial one), which uses canonical profiles of ion *Ti* and electron *Te* temperatures. From analysis of the T-10 profile database, we numerically seek the transport coefficients, providing the minimal RMS deviations of calculated *Te* and *Ti* profiles from experimental ones. We introduce the conception of equivalent shots, for which the energy transport in tokamaks and stellarators is similar. We construct two equivalent discharges for the W7-X stellarator [2] and for the T-15MD tokamak under construction [3], for which we calculate the energy transport in a wide range of densities using the Standard model. Figure 1 shows the central temperatures *Te* and *Ti* as functions of the average plasma density‾*n*. Triangles mark the experimental temperatures in W7-X, while circles mark the temperatures in T-15MD, calculated with the Standard model. Figure 2 presents comparison of calculated (T-15MD, solid) and experimental (W7-X, dashed) temperature profiles for discharges with on-axis EC-heating at the density ‾*n* = 3×1019 m-3.

Discharges form different tokamaks may be also equivalent. In particular, we show that in tokamaks with various major radii, the electron temperatures in equivalent discharges differ by 1−2%, and the ion temperatures differ by 10−12%. Finally, the joint (Standard + Global) transport model is applied for predictions of the plasma energy transport in various T-15MD discharges.

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| Fig. 1. The central electron *Те* and ion *Тi* temperatures, as functions of the average density in equivalent shots with EC heating at W7-X and T-15MD, *QEC*=5 MW. | Fig. 2. Calculated (T15MD) and experimental (W-7X) profiles of electron *Te* and ion *Ti* temperatures, on-axis ECH, *QEC*=5 MW, ‾*n*=3×1019 m-3. |

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Mu/ru/AA-Dnestrovskiy.docx) [↑](#endnote-ref-1)