study of ISOTOPE EFFECT ON central ELECTRON temperature in THE TUMAN-3M TOKAMAK plasmas [[1]](#footnote-1)\*)

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An analysis of the database of the TUMAN-3M tokamak hydrogen and deuterium discharges (circular cross - section, major and minor plasma radii: *R*pl = 53 cm and *a*pl = 22 cm, respectively, plasma current *I*pl = 126 - 152 kA, toroidal magnetic field *B*T = 0.8 - 1 T, central chord-averaged electron density = (1.5 – 3.6) ∙1019 m-3) for 2019 - 2022 was carried out. Ohmic discharges with a low level of hard X-ray emission, in which information about the electron temperature was available, were analyzed. The preliminary analysis based on 60 discharges showed that the central electron temperature *T*e(0) measured by soft X-ray foil technique in hydrogen plasma is higher than in deuterium one.

This observation contradicts numerous experimental studies of the isotope effect in tokamaks, where the confinement in the ohmic regime [1, 2] and in regimes with additional heating [3] improves with an increase in the atomic mass of the working gas.

For a more detailed study of the isotope effect, it was decided to select a couple of discharges from this database. An influence of the plasma isotope composition on the energy confinement time was studied using the ASTRA transport code. Hydrogen #19040902 and deuterium #20101909 discharges with similar discharge scenarios and basic plasma parameters were chosen for comparison. These discharges had the following parameters at time t = 47 ms: *I*pl = 152 kA, loop voltage *U*loop = (2.5 - 3) V, *B*T = 0.9 T, = 1.8∙1019 m-3. [While](https://context.reverso.net/%D0%BF%D0%B5%D1%80%D0%B5%D0%B2%D0%BE%D0%B4/%D0%B0%D0%BD%D0%B3%D0%BB%D0%B8%D0%B9%D1%81%D0%BA%D0%B8%D0%B9-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/while) *T*e(0) differs significantly: *T*e(0) = 600 eV in the hydrogen discharge and *T*e(0) = 450 eV in the deuterium one. The electron density profiles were obtained using the data of the microwave interferometer (wavelength 2 mm) with 10 vertical channels. The ion temperature *T*i was determined from diagnostic data based on the energy spectrum analysis of the fluxes of charge exchange atoms. In the discharges under consideration, the value of *T*i was ~260 eV regardless of the plasma isotope composition.

The report discusses the first results obtained on the basis of the preliminary analysis of the database of the TUMAN-3M tokamak ohmic discharges and also presents the simulation results.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/CB-Abdullina.docx) [↑](#footnote-ref-1)