DOUBLE-MC code: MODELing NEUTRAL FLUX fROM PLASMA [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.206

Mironov M.I., Chernyshev F.V., Afanasyev V.I., Melnik A.D., Navolotsky A.S., Nesenevich V.G., Petrov M.P., Petrov S.Ya.

Ioffe Institute, St. Petersburg, Russia, [post@mail.ioffe.ru](mailto:post@mail.ioffe.ru)

At present, modeling of neutral flux from high-temperature hydrogen plasma is becoming essential for neutral particle diagnostics, which is based on analysis of energy distribution of escaping atoms. In part, this is caused by growing density and size of plasma. That increases its opacity and makes simple analysis unusable. Also, many fusion research facilities are equipped with neutral beam injection systems, which could induce the growth of additional, so-called ‘active’, flux of atoms from plasma. These and other factors make it difficult to link measured spectra of atoms to plasma ion energy distributions. Often this can be done by numerical analysis only.

The report describes the DOUBLE-MC code, which models atomic fluxes of hydrogen (H,D,T) and helium (3He, 4He) isotopes emitted by hydrogen-helium magnetically-confined toroidal plasma in fusion experiments. The code was written in IOFFE Institute specifically for neutral particle diagnostics needs. It is a Monte-Carlo modification of the previous semi-analytical code [1]. Due to Monte-Carlo approach [2], more physical phenomena were accounted for in modeling the formation of charge-exchange target, namely hydrogen atoms and hydrogen-like impurity ions, in plasma. The description of the code includes physical basis, with the list of the main processes leading to formation of passive (when neutrals penetrate from edge) and active (beam-induced neutrals) charge-exchange target. The details on ion neutralization in plasma and attenuation of escaping atoms are given. The structure and algorithm of the code is described. The comparison of modeled atomic spectra with the ones measured by neutral particle analyzers in various plasma experiments is given.

References

1. Afanasyev V.I., Gondhalekar A., Kislyakov A.I. On the Possibility of Determining the Radial Profile of Hydrogen Isotope Composition of JET Plasmas, and of Deducing Radial Transport of the Isotope Ions // Preprint JET-R-(00)04. — Luxemburg: ECSC/EEC/EURATOM. — 1999.
2. J. M. Hammersley and D. C. Handscomb, Monte Carlo Methods, Chapman and Hall, London & New York, 1964

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/E/ru/JE-Mironov.docx) [↑](#footnote-ref-1)