A METHOD FOR RAPID ESTIMATION OF THE INFLUX OF A MIXTURE OF HYDROGEN ISOTOPES FROM THE WALL TO TOKAMAK PLASMA BY H-ALPHA SPECTROSCOPY [[1]](#footnote-1)\*)

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In [1], a modification of the well-known SXB method, used for evaluating the atom/ion influx from the tokamak first wall into plasma using the observed wavelength-integrated intensity of the H-alpha spectral line, was proposed. The method makes it possible to replace the equation corresponding to the DXB method for molecular spectra with another equation using the relation between the asymmetry of the line shape of spectral intensity and the atomic flux density. The method uses spatial profiles of atomic and molecular flux density, simulated with the modified Ballistic Model [2]. The method [1] allows, using the high-resolution spectroscopy data, to estimate – in real time measurements – the fluxes of atomic and molecular hydrogen from the first wall of the tokamak main chamber into plasma without measurements of molecular spectra. The modified SXB method was tested by comparing the results with the SOLPS code simulations for six modelled types of the SOL plasma profiles in ITER. The proposed modification is motivated by the fact that the hydrogen molecular spectra will not be used for ITER operation diagnostics because of difficulties of their interpretation. Method [1] makes it possible to find the fluxes of atoms and molecules of one kind of hydrogen isotopes near the wall only in order of magnitude in a certain range of ITER operating modes (low background from scattered divertor light, predominance of the contribution of one SOL section on the observation chord in the main chamber).

Here, the method [1] is generalized to the case of a mixture of hydrogen isotopes. As a result, it was possible to obtain a system of equations that take into account the wavelength-integrated radiation intensity and the asymmetry of the spectral profile of the line, and have such unknowns: the so-called conversion flux densities of atoms of each type (i.e., atoms formed by recombination of ions leaving the plasma without converting the formed atoms into molecules on the wall with the wall temperature) and flux densities of different types of molecules from the wall (e.g., DT molecules).

The relationship between the asymmetry of spectral lines and the atomic flux density can be added to the set of equations that are solved in multiparameter inverse problems [3-5], which are not yet solved in real time.

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