Algorithm of calculating the passive signal of tokamak edge plasma for CXRS diagnostics [[1]](#footnote-1)\*)

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1Sdvizhenskii P.A., 1,2Kukushkin A.B., 1Levashova M.G., 1,2Lisitsa V.S., 1Neverov V.S., 3Serov S.V., 3Tugarinov S.N.

1NRC “Kurchatov Institute”, Moscow, Russia, [Sdvizgenskii\_PA@nrcki.ru](mailto:Sdvizgenskii_PA@nrcki.ru)  
2National Research Nuclear University MEPhI, Moscow, Russia  
3Project Center ITER, Moscow, Russia

Active spectroscopic diagnostics is widely used in modern tokamaks to measure such important plasma parameters as the concentration and distribution of impurities, the profiles of the ion temperature and the rotation speed of the plasma. CXRS Edge diagnostics on ITER will be located in the third equatorial port plug and will take measurements for the outer part of the plasma, from the plasma entry point to the middle of the plasma's small radius.

Passive signal in CXRS diagnostics is formed by charge exchange of the ions in the tokamak plasma periphery on neutral hydrogen isotopes atoms coming from the vacuum chamber first wall during the recycling process. Predictive modeling of passive signal remains a problem, as it requires a number of theoretical tasks to be solved together, which need sophisticated numerical modeling.

For the modeling of passive signal in CXRS Edge diagnostics we developed an algorithm that includes: (i) using the data of modeling the SOL (and divertor) plasma with account of impurities to be diagnosed with the CXRS Edge diagnostics (such data are accumulated and being extended; for ITER see simulations with the SOLPS (B2-EIRENE) [1] and OSM+EIRENE+ DIVIMP [2] codes); (ii) using the data for cross-sections of charge exchange reactions, which produce highly-excited atomic states of H-like impurity ions from collisions of impurity nuclei with hydrogen isotopes neutral atoms (including their low-lying excited states) of background plasma; (ii-a) evaluation of charge exchange cross sections not covered by the existing databases; (iii) calculation of the rates of the above-mentioned reactions for essentially non-Maxwellian velocity distributions function (VDF) of hydrogen isotopes neutral atoms (the VDF data may be generated, e.g., by stand-alone EIRENE code [3] simulations using the background SOL plasma data of item “i”); (iv) calculation of the photon emission coefficients (PEC) data for interested impurity visible-light spectral lines in the case “iii” which is beyond the available data in ADAS and similar sources (these data may be generated, e.g., with the code [4], similarly to evaluation of CXRS active signal in [5]).

Here we describe the algorithm of modeling the passive signal of edge-CXRS diagnostics in tokamaks, which uses the data (i)-(iv). Some preliminary results for passive signal of the ITER Edge CXRS diagnostics are presented.

References

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