SIMULATION OF PASSIVE CHARGE EXCHANGE SIGNALS OF HYDROGEN-LIKE BERYLLIUM IONS FOR CXRS EDGE DIAGNOSTICS IN ITER [[1]](#footnote-1)\*)

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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, which has not yet been carried out to the right extent.

Here, in accordance with the previously developed algorithm [1], the background radiation from passive charge exchange was calculated for one of the beryllium (Be IV) spectral lines used for Charge eXchange Recombination Spectroscopy (CXRS) diagnostics for one of the divertor's operation scenarios in ITER. The contribution of the charge exchange of beryllium ions Be V on neutral deuterium atoms in the ground and first excited states is calculated. The cross sections for the charge exchange reaction calculated by the numerical code ARSENY [2] and other codes are used. The data from the ITER edge plasma modeling database is used based on the SOLPS [3, 4] numerical code: calculations of the kinetics of deuterium recycling by the EIRENE [5] code and the erosion of the beryllium first wall by the ERO2.0 [6] code. The effective photon emission coefficients are calculated by *nl*-KINRYD [7] code.

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References

1. Sdvizhenskii P.A., Kukushkin A.B., Levashova M.G., *et al*. In: Proc. 46th EPS Conf. Plasma Phys. Milan, Italy, 2019, ECA, vol. 43C, P4.1006.
2. Solov’ev E.A.Workshop on Hidden Crossings in Ion-Collisions and in Other Nonadiabatic Transitions. Harvard Smithonian Centre for Astrophysics, 1991.
3. Kukushkin A.S., Pacher H.D., Kotov V., *et al*., Fusion Eng. Des. 2011, **86**, 2865.
4. Lisgo S.W., Börner P., Kukushkin A., *et al*., J. Nucl. Mater. 2011, **415**, S965.
5. Reiter D., Baelmans M., Börner P. Fusion Sci. Technol. 2005, **47**, 172.
6. Romazanov J., Brezinsek S, Kirschner A, *et al*. Contrib. Plasma Phys., 2019, DOI: 10.1002/ctpp.201900149; https://onlinelibrary.wiley.com /doi/full/10.1002/ctpp.201900149
7. Kadomtsev M.B., Levashova M.G., Lisitsa V.S., JETP 2008, **106**, 635-649.

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