



Seminar: Division of Nuclear Energy and Environmental Studies (UZ3)
Department of Complex Systems (DUZ)
Tuesday: **25.02.2025, 11:30 AM**

Hybrid seminar: room 172, building 39 (Cyfronet, 3rd floor)

Online broadcast: <https://www.gotomeet.me/NCBJmeetings/uz3-and-phd4gen-seminars>

Speaker: online

Jędrzej Walkowiak
NCBJ

**Impact of tungsten impurities on electrons dynamics of
thermonuclear plasma in tokamaks**

Abstract:

The selection of tungsten as a plasma-facing material for the ITER tokamak has raised the importance of suprathreshold electron interactions with partially ionized impurities in plasma modeling. A detailed description of fast electrons collisions with non-fully ionized impurities requires calculation of two parameters: the atomic form factor for elastic collisions and the Mean Excitation Energy (MEE) for inelastic collisions. The ab initio models that can be used for this purpose are accurate, but very time consuming in practice. I evaluate existing approximations of the atomic form factor derived from the Pratt–Tseng and Thomas–Fermi models. I consider ab initio density functional theory (DFT) calculations as a reference to assess the accuracy of these models. I then propose several changes to the Pratt–Tseng model, optimized with numerical parameter adjustments. I determine values of MEE, employing a semi-empirical formula based on the Local Plasma Approximation (LPA). The obtained models and data were used to extend the disruption and runaway electron analysis model code DREAM, allowing to include tungsten impurities in disruption simulations.

You are cordially invited,
Tomasz Kwiatkowski, Mariusz Dąbrowski

Bio:

dr inż. Jędrzej Walkowiak – a graduate of the Poznań University of Technology, defended his doctorate in 2025 at the Institute of Nuclear Physics of the Polish Academy of Sciences on the subject of thermonuclear fusion. He works in the Department of Nuclear Energy and Environmental Studies (UZ3) at NCBJ, where he participated in the preparation of the basic design of the HTGR-POLA reactor, among other projects. He is currently a postdoc at the Max Planck Institute for Plasma Physics in Greifswald, Germany, where he is involved in thermohydraulic calculations for a fusion reactor.