

Study of the mutual dependence between Lower Hybrid current drive and heavy impurity transport in tokamak plasmas

Harmonia (NCN) – Working Meeting, 7/11/2022 – 8/11/2022

Académie Polonaise des Sciences, Centre Scientifique à Paris
74 rue Lauriston, 75116 Paris

The general goal of this meeting was to discuss recent advances on the mutual impact of W non-fully ionized impurities, LHCD modeling, fast electron dynamics and associated diagnostic issues – in particular on the WEST tokamak – in the framework of the Harmonia (NCN) project, conducted in collaboration between the Polish Institute of Nuclear Physics Polish Academy of Sciences (IFJ PAN) and the French Institute for Magnetic Fusion Research (IRFM, CEA).

➤ List of presentations:

- Yves Peysson, “Progresses in LHCD/HXR simulations and open questions”
- Jędrzej Walkowiak, “Elastic and inelastic collisions for a Fokker-Planck collision operator”
- Martin O’Mullane, “Incorporating non-Maxwellian distributions in atomic coefficients for plasma emission modelling”
- Jacek Rządkiwicz, “High-resolution x-ray spectroscopy relevant to the diagnostic of high temperature tokamak plasmas”
- Didier Mazon, “SXR measurement and associated inversion: a crucial tool for controlling fusion performances”
- Axel Jardin, “SXR tomographic reconstruction and W density estimation uncertainties”

➤ **Event on Paris PAN station website before the meeting:**

<https://paris.pan.pl/en/events/study-of-the-mutual-dependence-between-lower-hybrid-current-drive-and-heavy-impurity-transport-in-tokamak-plasmas/>

Global energy consumption has increased significantly over the last century. In 1973, for example, there was 6,000 million tonnes of oil equivalent, and in 2016 it was already over 13,200 million tonnes of it. Global energy demand is expected to continue to grow in the near future. Fossil fuels are currently the dominant source of energy and account for about 80% of global energy consumption. However, fossil fuel reserves are limited. Therefore, controlled thermonuclear fusion could be a prime candidate for energy production in the future. The tokamak device is currently the most promising solution for controlled thermonuclear fusion and future energy production. In this device, the fusion plasma is maintained by means of a strong toroidal magnetic field induced by external coils and a poloidal magnetic field generated by the current flowing in the plasma. However, there are still many scientific and technological challenges on the way to building a fusion power plant. One such challenge is the effective control of the current profile flowing in the plasma to ensure the stability of its maintenance in the tokamak. Of the many techniques, a method based on the emission of electromagnetic waves at frequencies corresponding to the so-called lower hybrid frequency plays a key role in controlling the current profile by optimising the deposition of electromagnetic wave energy in the plasma. The meeting will focus on specific issues related to current profile control in fusion reactors by means of e-m waves.

