# The GOLEM tokamak bibliography

The tokamak GOLEM team

SGS 2024 relevant

## Official GOLEM Articles

**Abbasi et al.: Artificial Neural Network-Based Tomography Reconstruction of Plasma Radiation Distribution at GOLEM Tokamak** **Abbasi-2024-JOFE**

S. Abbasi et al. "Artificial Neural Network-Based Tomography Reconstruction of Plasma Radiation Distribution at GOLEM Tokamak". In: *Journal of Fusion Energy* 43.2 (2024), p. 64. ISSN: 1572-9591. DOI: 10.1007/s10894-024-00458-z. URL: https://doi.org/10.1007/s10894-024-00458-z.

Abstract: The paper presents an artificial neural network-based model for tomography reconstruction of visible plasma radiation distribution at the GOLEM tokamak. The model was trained using a dataset from emissivity phantoms and associated synthetic measurements from a poloidal cross-section of the GOLEM tokamak. The model validation was performed on the prediction of various unseen phantom samples with shapes similar to those in the training dataset. The backfit of line-integrated measurements indicates the considerable potential of the proposed model for reconstructing the position, size, shape and intensity of the radiation function of one cross section. Additionally, the neural network-based model offers a significantly shorter prediction time compared to traditional tomography methods, providing a substantial advantage.

**Dimitrova et al.: Plasma properties in the vicinity of the last closed flux surface in hydrogen and helium fusion plasma discharges** **Dimitrova-2024-PPCF**

M Dimitrova et al. "Plasma properties in the vicinity of the last closed flux surface in hydrogen and helium fusion plasma discharges". In: *Plasma Physics and Controlled Fusion* 66.7 (2024), p. 075022. DOI: 10.1088/1361-6587/ad5377. URL: https://dx.doi.org/10.1088/1361-6587/ad5377.

Abstract: The origin of the bi-Maxwellian electron energy distribution function (EEDF) observed in the scrape-off layer (SOL) of tokamak plasmas by means of Langmuir probes is still under discussion. It has been assumed that the ionization of hydrogen and deuterium neutrals by thermal electrons penetrating the SOL from the bulk plasma is the main reason for the appearance of a second Maxwellian. To validate this assumption, radial measurements of the electron temperatures and densities, or the plasma properties in helium plasmas in the GOLEM tokamak and the TJ-II stellarator were performed. The radial profiles of the low-temperature electron group densities follow the trend of the calculated radial profiles of the electron sources arising from the ionization of neutrals in both deuterium and helium plasmas in TJ-II. The difference in the radial location where the bi-Maxwellian EEDF appears can be explained by the difference in the rate coefficients for ionization of deuterium and helium. The results of probe measurements in GOLEM and the WEST tokamak divertor, at one radial location in the SOL, are compatible with the hypothesis concerning the ionization of neutral atoms and the type of the EEDF.

## Conference proceedings

**Abbasi et al.: Plasma Tomography at GOLEM Tokamak using Neural Network model** **Abbasi-2024-ECPP**

S. Abbasi et al. "Plasma Tomography at GOLEM Tokamak using Neural Network model". In: vol. 48A. Europhysics conference abstracts. 2024. ISBN: 111-22-33333-44-5. URL: https://lac913.epfl.ch/epsppd3/2024/html/PDF/P2-094.pdf.

**Vinklarek et al.: Tokamak GOLEM for fusion education - chapter 15** **Vinklarek-2024-ECPP**

J. Vinklarek et al. "Tokamak GOLEM for fusion education - chapter 15". In: vol. 48A. Europhysics conference abstracts. 2024. ISBN: 111-22-33333-44-5. URL: https://lac913.epfl.ch/epsppd3/2024/html/PDF/P2-092.pdf.

## Master thesis

**Godsfavour Chibueze Amanekwe: New Set of Inner Magnetic Coils at the GOLEM Tokamak** **Bohous-2024-MastThes**

Godsfavour Chibueze Amanekwe. "New Set of Inner Magnetic Coils at the GOLEM Tokamak". Master Thesis. 2024. URL: http://golem.fjfi.cvut.cz/wiki/Presentations/Students/MasterThesis/24GodsfavourAmanekwethesis.pdf.

Abstract: Systems of magnetic diagnostics belong to the backbones of magnetic confinement fusion devices. The GOLEM tokamak has as a part of the control system a Rogowski coil for the plasma current measurement, and a small coil for the toroidal field measurement, both outside the vacuum chamber. A new system of magnetic coils was recently developed and installed inside the GOLEM vacuum vessel. The system consists of a Rogowski coil, two toroidal field coils placed on the high field side (HFS) and the low field side (LFS), and a diamagnetic coil. The inner Rogowski coil measures the plasma current being undisturbed by the current in the liner. The inner toroidal coils measure the toroidal field without the effect of the field penetrating through the liner. The most important contribution is provided by the diamagnetic coil used to establish the thermal plasma energy and the energy confinement time. First results from testing the new system are presented in this thesis. The coils were tested and calibrated, with the offsets and parasitic artefacts removed. They now measure with enhanced precision and have been embedded into the shot web-page and database of the GOLEM tokamak together with the calculated thermal plasma energy and the energy confinement time.

# Bachelor projects

**Catalina Vásquez Leiva: Estudios de optimización de confinamiento magnético de plasmas en tokamak GOLEM**
**Catalina-2024-BachProj**

Catalina Vásquez Leiva. "Estudios de optimización de confinamiento magnético de plasmas en tokamak GOLEM". Bachelor project. 2024. URL: `http://golem.fjfi.cvut.cz/wiki/Presentations/Students/FromAbroad/24Catalina-Spanish.pdf`.

Abstract: En este informe se presenta el estudio realizado mediante la operación remota del tokamak GOLEM de la Universidad Técnica Checa de Praga. Se coordinaron tres sesiones experimentales para realizar descargas en el tokamak, pudiendo controlar distintos parámetros como la intensidad del campo magnético toroidal, la intensidad del campo eléctrico , el gas a utilizar (hidrógeno o helio) y su presión. El objetivo principal de la investigación fue estudiar cómo se comporta el tiempo de confinamiento con respecto a estos parámetros, en particular la intensidad del campo magnético. En adición a esto, se buscó identificar impurezas en el plasma mediante un análisis del espectro del plasma. La primera sesión de experimentos se destinó principalmente a estudiar la relación entre el tiempo de confinamiento y el campo magnético toroidal, utilizando gas de hidrógeno. En la segunda sesión se buscó corroborar los resultados anteriores y se utilizó espectroscopía para estudiar las impurezas. Finalmente, en la tercera sesión se corroboraron nuevamente resultados anteriores con respecto al tiempo de confinamiento y a espectroscopía utilizando además gas de helio. Se encontró que el tiempo de confinamiento tiende a aumentar cuando se incrementa el campo magnético, lo cual es consistente con estudios realizados con otros tokamaks. También se encontró que tanto la corriente de plasma como la temperatura tienden a disminuir cuando se incrementa el campo magnético, sin embargo la influencia de la presión del gas no fue estudiada en profundidad. Con respecto al análisis mediante espectroscopía, se lograron identificar impurezas como oxígeno, nitrógeno, carbono, hierro y molibdeno.

**Derap Pena Mukti Sari: The Study of The Hydrogen Plasma Breakdown Phase in The GOLEM Tokamak Reactor**
**Sari-2024-BachProj**

Derap Pena Mukti Sari. "The Study of The Hydrogen Plasma Breakdown Phase in The GOLEM Tokamak Reactor". Bachelor project. 2024. URL: `http://golem.fjfi.cvut.cz/wiki/Presentations/Students/FromAbroad/24DerapPenaMuktiSari-English.pdf`.

Abstract: The breakdown phase of plasma in a tokamak is a crucial stage before achieving fusion conditions. This stage will influence the quality of electron production, plasma purity, plasma stability, and more. This study aims to determine the optimum parameters during the breakdown phase in the GOLEM tokamak by examining the effects of gas pressure and transformer core voltage on breakdown voltage, discharge duration, and maximum plasma current. The research is conducted remotely using a computer to access the website connected to the GOLEM tokamak. Eighty discharge data points from the GOLEM tokamak website database are plotted into graphs. The optimal gas pressure falls within the range of 7-15 mPa. In this pressure range, the discharge duration (Tdis) and maximum plasma current (Ip, max) reach relatively the highest values (11,59 - 13,56 ms; 2,6 - 3,82 kA). An increase in the transformer core voltage (UCD) results in an elevation of breakdown voltage (Ubreakdown), discharge duration (Tdis), and maximum plasma current (Ip, max).

# High School Students' Professional Activities