Electron cyclotron emission measurements at the optically thin plasmas of the stellarator TJ-K

G. Sichardt\textsuperscript{1}, E. Holzhauer\textsuperscript{1}, A. Köhn\textsuperscript{2}, M. Ramisch\textsuperscript{1}, T. Hirth\textsuperscript{3}

\textsuperscript{1} Institute of Interfacial Process Engineering and Plasma Technology, Stuttgart, Germany
\textsuperscript{2} Max-Planck-Institut für Plasmaphysik, Garching, Germany
\textsuperscript{3} Karlsruhe Institute of Technology, Karlsruhe, Germany

At the stellarator TJ-K a diagnostic system is being set-up analysing the microwave radiation from the plasma. The second harmonic electron cyclotron emission (ECE) is identified by examination of the dependence of the emitted radiation on electron density and electron temperature. The reference data for density and temperature is obtained using Langmuir probes. For the magnetic field in TJ-K the second harmonic ECE radiation is in the range of about 10 GHz to 19 GHz. For these frequencies the plasma in the stellarator is optically thin. Therefore, the emitted microwaves can pass through the plasma and undergo multiple reflections at the vessel wall until they finally reach the antenna of the diagnostics. This complex behaviour makes it necessary to narrow the volume of observation of the diagnostics. A mirror optimised with respect to the antenna pattern including the influence of the plasma is installed at the inner vessel wall opposite the antenna to concentrate the observation between antenna and mirror. With this setup the reconstruction of the temperature profile is possible using the calculated magnetic field geometry and the measured plasma density. It is shown that in typical TJ-K plasmas the shape of the density profile is fairly constant. Therefore, the temperature profile can be inferred from the line averaged density non-invasively.

Non-resonant heating scenarios in TJ-K show notable toroidal net currents that could be explained by non-thermal electrons. In this context an important property of the ECE diagnostics is that non-thermal electrons can be detected. Numerical simulations of particle trajectories are deployed to examine the role of electron drift orbits in TJ-K. The generation of toroidal net currents due to directional electron losses is analysed.