Full-wave simulation of mode-converted electron Bernstein waves at very low magnetic field in the SCR-1 Stellarator

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SCR-1 is a 2-field period small modular Stellarator ($R = 247.7\,\text{mm}$, $R/a = 6.2$, $\iota_a = 0.264$) with a very low magnetic field ($< B >= 41.99\,\text{mT}$) and an ECR heating frequency of $2.45\,\text{GHz}$ ($5\,\text{kW}$). Few studies on conversion of electrostatic Bernstein waves under these conditions have been performed in Stellarators [1, 2]. This work presents the results of converting electrostatic Bernstein waves in the SCR-1 Stellarator using the full wave code IPF-FDMC [3], taking the 3D magnetic field obtained by VMEC code as input and the experimental electron density profile obtained using a Langmuir probe. New microwave heating scenarios that take the SCR-1's vacuum vessel into account in order to improve the O-X conversion due to reflection of the incoming radiation from the ECRH system are presented. The results indicate a single pass O-X mode conversion is around 3%. The possible location of a microwave antenna and its characteristics for proper function in SCR-1 stellarator are explained. Additionally, the improvements in BS-SOLCTRA code (Biot-Savart Solver for Compute and Trace Magnetic Fields) are shown. This code was developed by our research group to calculate 3D magnetic fields and display the magnetic surfaces in SCR-1. The road to convert it into a parallel and high-performance computing platform for tracing particles in SCR-1 is shown. Finally, the results of the comparison of the flux surfaces measured with an electron beam and fluorescent rod, with computed flux surfaces by means of BS-SOLCTRA code are shown. Similarly, the designs of the magnetic diagnostics (Rogowski, Voltage Loops and Mirnov) and the bolometer that will be installed in SCR-1 are presented.

References

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