Fast Wave Devices

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Nuclear fusion is one of the most promising long-term options for a sustainable, non-carbon emitting global energy supply. The most prominent nuclear fusion experiment under construction is ITER. In parallel, a number of exciting start-ups are emerging around the world. All of them demand for powerful, flexible and efficient heating methods, one of which is the Electron Cyclotron Resonance Heating (ECRH). It allows for localized plasma heating and stabilization. Gyrotron oscillators (gyrotrons) provide the microwave power at Megawatt-levels and at the required frequencies ranging from below 100 GHz to significantly above 200 GHz. Beyond that, latest research in gyrotrons offer advanced operating modes for plasma heating and diagnostics.

In this lecture, the physics and technologies of gyrotrons will be introduced briefly. Advances in gyrotron research and development, focusing on the developments at Europe, will be provided. It includes the advances in hollow-cavity gyrotrons for European plasma experiments, coaxial-cavity development for future DEMO, the multi-stage depressed collector concept and advanced frequency control of megawatt-class gyrotrons.