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P4.1078 The depolarizing effect of plasma density fluctuations on microwave beams

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Microwaves play an indispensable role in plasma experiments for heating and diagnostic purposes. This is especially true for fusion experiments on the path towards a burning plasma in which only little space is available for any type of internal hardware installations. Electromagnetic waves in the microwave frequency range offer the advantage of requiring comparatively little space inside the machine [1].
Microwaves injected into the plasma or being emitted by it have to traverse the plasma edge, a region where significant plasma density fluctuations with fluctuation levels of several 10 % are known to occur [2]. If those fluctuations are located at very low plasma density values, an energy transfer between the two modes of the microwave, the O- and X-mode, can occur. This mode scattering can be a problem for high-power microwave injection as the unwanted mode would likely not be absorbed at the intended spatial location but could instead deposit its power elsewhere and might even constitute a threat for wall components. Here we present full-wave simulations [3, 4] to illustrate and estimate the importance of this effect. We will discuss its relevance for the next generation tokamak ITER, currently under construction. The full-wave simulations will also be used to compare with previously performed calculations using a wavekinetic equation solver which accounts for the effect of density fluctuations in the limit of the Born approximation [5].
References
[1] H.-J. Hartfuss et al., Fusion Plasma Diagnostics with mm-Waves (Weinheim: Wiley, 2014) [2] S.J. Zweben et al., Plasma Phys. Control. Fusion 49, S1 (2007) [3] A. Köhn et al., Plasma Phys. Control. Fusion 50, 085018 (2008) [4] P. Aleynikov et al., EPJ Web of Conf. 149, 03007 (2017) [5] A. Snicker et al., Plasma Phys. Control. Fusion 60 014020 (2018)

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