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P2.1070 Advanced RF heating schemes in preparation for ICRF heating and fast ion experiments in the W7-X stellarator

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Fast ion confinement is crucial for the demonstration of the stellarator approach towards fusion energy. To study confinement of fast ions with today's stellarators advanced RF heating schemes can be used to generate fast ions. Secondly, advanced RF heating schemes are developed to improve ion heating performance. Advanced ICRH schemes (e.g. the 3-ion species scheme [1]) have the advantage of improved polarization, so the wave energy is nearly completely carried by the left hand polarized wave at resonance, thereby providing good power transfer to the ions. However, modelling of minority and 3-ion species heating in W7-X has shown that the fast ion tails are limited, and core heating is modest [3]. Additionally, the highly anisotropic distributions generated by the minority and 3-ion species schemes are not well confined. Furthermore, the high density plasma of W7-X creates difficulty heating thermal particles because of the high collisionality. An advantage of the so called RF-NBI synergetic scheme is that NBI born ions are weakly collisional at birth. Secondly, compared to other ICRH schemes the RF-NBI scheme heats more in the parallel direction, generating less trapped ions. Thirdly, a more isotropic velocity distribution is also desirable for fast ion studies since fusion born alphas are isotropic as well [2, 3]. The code SCENIC [4] is used to model ICRH scenarios in 3D. The code is comprised of a magnetic equilibrium code, a full wave code and a Fokker-Planck code. It is able to determine wave propagation and absorption in hot plasma with full FLR effects. Lastly, effects of finite orbit width effects and wave absorption on the distribution function are taken into account. This contribution will explore RF-NBI and other advanced heating schemes in W7-X relevant plasma scenarios prior to ICRF heating and fast ion experiments.
References
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