EBW H&CD Potential for Spherical Tokamaks*

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Spherical tokamaks (STs), which feature relatively high neutron flux and good economy, operate generally in high-ß regimes, in which the usual EC O- and X- modes are cut-off. In this case, electron Bernstein waves (EBWs) seem to be the only option that can provide features similar to the EC waves—controllable localized heating and current drive (H&CD) that can be utilized for core plasma heating as well as for accurate plasma stabilization. An extensive numerical study of EBW H&CD performance in four typical ST plasmas (NSTX L- and H-mode, MAST Upgrade, NHTX) is performed. Coupled ray-tracing (AMR) and Fokker-Planck (LUKE) codes are employed to simulate EBWs of varying frequencies and launch conditions, which are the fundamental EBW parameters that can be chosen and controlled. Our results indicate that an efficient and universal EBW H&CD system is indeed viable. In particular, power can be deposited and current reasonably efficiently driven across the whole plasma radius. Such a system could be controlled by a suitably chosen launching antenna vertical position and would also be sufficiently robust.

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