Benchmarking ion-ion-orbit-following codes, SPIRAL and ASCOT5 on Toroidal Alfven Eigenmodes

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The ion-orbit-following codes, SPIRAL and ASCOT5, are crucial tools for modeling energetic ion orbits, particularly fusion-generated alpha particles, in tokamak environments. Their prime function is to determine the proportion of alpha particles lost to the wall and evaluate the resultant surface heating, which can potentially induce wall melting. The two codes have been benchmarked in the SPARC tokamak to assess particle losses, power losses, and ripple losses. The anticipated minimal ripple losses imply a tolerable level of surface heating. Given the insignificant classical fast ion losses, SPARC affords us an opportunity to investigate fast-ion redistributions triggered by MHD instabilities, which are typically minor. The most notable among the MHD instabilities are the Toroidal Alfven Eigenmodes (TAEs), which might instigate additional losses. In this study, we aim to simulate alpha particle orbits in the SPARC tokamak utilizing SPIRAL and ASCOT5, factoring in the presence of TAEs. Our first step involves benchmarking these codes against each other to ensure the reliability of the simulations. Subsequently, we intend to examine the patterns of resultant surface heating on SPARC due to the TAEs.

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