

Abstract Submitted  
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**A Hybrid Particle Method for the Kinetic Treatment of Magnetized Plasma Sheaths using Full Orbit to Guiding Center Conversion<sup>1</sup>**

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— The guiding center approximation is commonly adopted in fusion particle codes to resolve the motion of charged particles in the core and at the plasma edge of a magnetic fusion device. However, the guiding center approximation does not hold at regions where the field gradients are large, such as the plasma sheath and presheath formed in front of a material surface. Here we present a hybrid particle method, which converts the guiding center particles into finite-orbit particles once they reach a region close to the boundary, where the field gradients become large. The domain is divided in a guiding center region and a full-orbit region, and the conversion of the particle is performed both ways. The conversion requires the adoption of a ring-charge method to avoid discontinuities in the potentials. We present numerical results from an implementation of this new scheme within the hPIC Particle-in-Cell developed at Illinois. We show that the approach can accurately resolve the full-orbit physics of the plasma sheath, still allowing to treat the vast majority of the plasma bulk with the usual guiding-center approximation.

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