Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Fast Ion Orbit Topology in the Reversed-Field Pinch[1] J.L. CLARK, Florida A&M University, W. CAPECCHI, J. EGEDAL, J.K. ANDERSON, University of Wisconsin - Madison — Fast ion orbit tracing through the RFP's equilibrium magnetic field (ignoring the substantial turbulent contribution) can lend insight into the behavior of fast particles. Ion orbit topology, as studied in tokamak and spherical torus geometries by considering the motion of the guiding center with a conserved angular momentum p_ϕ and magnetic moment μ, reveals several of the well known fast ion orbits in the RFP as well, such as kidney, D, pinch, banana, cusp, stagnation, and passing. While most orbits are similar to those found in conventional tokamaks, additional orbit types are possible in a RFP, as contours of constant μ in the RFP resemble mirrored parabolas with the foci leading to the magnetic axis, as opposed to a single set of parabolas with foci leading to the high field side. The tangential orientation of the NBI on MST corresponds to a path in the R,χ topology plane, where R is the major radius and χ is the cosine of the pitch angle at the Z=0 midplane, with co-passing, D, and banana orbits. A majority of the NBI-born ions are on co-passing orbits with a gyro-radius of order 10% of the minor radius. Following the complete ion orbit reveals a slight non-conservation of magnetic moment but this has a negligible effect on orbits crossing topological borders from confined orbits to lost orbits. Consideration of orbits in a very high beta (26%) RFP equilibrium with a deeply reversed toroidal magnetic field leads to the creation of two new orbit topology boundaries in the R,χ plane.

[1]Work supported by DOE.

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Date submitted: 11 Jul 2013 Electronic form version 1.4