

Abstract Submitted  
for the APR06 Meeting of  
The American Physical Society

**Ray tracing for ballooning modes in quasi-symmetric stellarators<sup>1</sup>**

E. MONDLOCH, A. S. WARE, University of Montana, R. SANCHEZ, Universidad Carlos III de Madrid, D. S. SPONG, D. DEL-CASTILLO-NEGRETE, Oak Ridge National Laboratory — The ray tracing techniques introduced by Dewar and Glasser [R. L. Dewar and A. Glasser, *Phys. Fluids* **26**, 3038 (1983)] are used to examine global ballooning stability for three different quasi-symmetric stellarator equilibria: the quasi-poloidally symmetric QPS, the quasi-helically symmetric HSX, and the quasi-axisymmetric NCSX. In the ray tracing method, global ballooning mode stability is calculated by following rays in the eigenvalue space determined by the results of local, infinite- $n$  ballooning theory. For all three of these configurations, the unstable structures are of the localized, ballooning type and are limited to narrow bands of field lines. This is true even well above a marginal stable  $\beta$ . The range of *alpha* (where  $\alpha$  is the field line label) for which unstable surfaces are found is broader in QPS than in NCSX while the range of  $\theta_k$  (where  $\theta_k = k_q/k_\alpha$  is the ballooning parameter) for which unstable surfaces are found is narrower in QPS than in NCSX. For HSX, the weak global shear results in modes which only weakly depend on the ballooning parameter,  $\theta_k$ . This weak dependence makes the ray tracing for HSX challenging.

<sup>1</sup>Work supported by U.S. Department of Energy under Grant DE-FG02-03ER54699 at the University of Montana and Contract DE-AC05-00OR22725 at ORNL with UT-Battelle, LLC.

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Date submitted: 13 Jan 2006

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