Abstract Submitted
for the APR12 Meeting of
The American Physical Society

Are the electric field resonances in stellarator transport real?[1]
MATT LANDREMAN, MIT Plasma Science & Fusion Center — Numerical calculations of the transport coefficients in stellarators predict that the radial transport becomes large for "resonant" values of the radial electric field. These resonances are understood to occur due to particles that do not experience an effective rotational transform due to the sum of parallel plus $E \times B$ motion. However, here it is argued that the resonances are an artifact of the "monoenergetic and local" approximation used in the calculations, in which the kinetic energy rather than total energy (kinetic plus electrostatic potential) is taken as a constant of particle motion. Due to the nonzero width of particle orbits, potential energy is not constant when a radial electric field is present, and the resulting variation in $v_{||}$ prevents particles from staying in resonance. We prove this point by explicitly calculating particle orbits without making the monoenergetic approximation. We also analytically calculate the radial ion heat transport in several idealized stellarator fields to show that when the monoenergetic approximation is not made, no resonance appears.

[1]Supported by DoE grant DE-FG02-91ER-54109 and through the Fusion Energy Postdoctoral Research Program administered by the Oak Ridge Institute for Science and Education.

Matt Landreman
MIT Plasma Science and Fusion Center

Date submitted: 09 Jan 2012 Electronic form version 1.4