Abstract Submitted
for the TSF11 Meeting of
The American Physical Society

Propagation of a constant velocity fission wave MARK DEINERT, The University of Texas at Austin — The ideal nuclear fuel cycle would require no enrichment, minimize the need fresh uranium, and produce few, if any, transuranic elements. Importantly, the latter goal would be met without the reprocessing. For purely physical reasons, no reactor system or fuel cycle can meet all of these objectives. However, a traveling-wave reactor, if feasible, could come remarkably close. The concept is simple: a large cylinder of natural (or depleted) uranium is subjected to a fast neutron source at one end, the neutrons would transmute the uranium downstream and produce plutonium. If the conditions were right, a self-sustaining fission wave would form, producing yet more neutrons which would breed more plutonium and leave behind little more than short-lived fission products. Numerical studies have shown that fission waves of this type are also possible. We have derived an exact solution for the propagation velocity of a fission wave through fertile material. The results show that these waves fall into a class of traveling wave phenomena that have been encountered in other systems. The solution places a strict conditions on the shapes of the flux, diffusive, and reactive profiles that would be required for such a phenomenon to persist. The results are confirmed numerically.

Mark Deinert
The University of Texas at Austin

Date submitted: 12 Sep 2011 Electronic form version 1.4