1086-37-1262 **Alexander Wittig*** (wittigal@msu.edu), Biomedical and Physical Sciences Bldg, 567 Wilson Rd., East Lansing, MI 48823, and **Martin Berz**. *Analysis of Dynamical Systems in Accelerator Physics using Verified Computation.*

In the design and analysis of particle accelerators, dynamical systems emerge in a natural way. In Beam Physics accelerators are described by a special Poincaré section called the transfer map. This map is a non-linear symplectic map exhibiting chaotic motion in certain regions of phase space.

One of the goals of accelerator design is to identify and avoid such regions. Of particular interest is the estimation of the so called region of stability of a given system. Typically this task is performed by repetitive particle tracking to obtain tracking pictures.

In this talk we describe a method to compute rigorous enclosures of all fixed or periodic points of a given order in a map using Taylor Model methods. We then apply this algorithm to a real world transfer map of the Tevatron accelerator to rigorously identify resonances.

This mathematically rigorous method yields all regions where resonances up to a certain order appear. The island structure exhibited by the map around the identified periodic points is then studied further by computing the invariant manifolds associated with the hyperbolic periodic points of the map. The manifold structure around the periodic points provides further insight into the dynamics of the map, including the emergence of chaotic motion. (Received September 20, 2012)