Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Mathematical Foundations for Fields of Toroidal Current Loops
STEPHEN SHARMA, University of Southern California — Motivating the functions that define electromagnetic fields for a toroidal shaped current loop are centered around three main isomorphisms: fundamental additions to solutions of differential equations, solving for the geodesics of thermonuclear magnetic reactors, and constructing accurate computational combinatoric models for fusion plasmas. Thermonuclear plasmas in tokamaks are essentially loops of current where the ions and electrons create two current densities which contribute to the magnetic field of the electricity generating current loop. The toroidal shaped current loop necessitates, however, new calculus. In the Biot Savart circular loop, off axis solutions are generated from an integral of a line segment. The non circular shape's differing eccentricity is in corner regions and the linear section and requires new integration and coordinates. The solution of the incremental loop elements in the toroidal shaped coil case are now loops considered parts of semicircles and step functions. When constructing a field, new elliptic functions are going to be generated and a new polynomial function—called an elliptic function of the first and second kind—must be uncovered.

Stephen Sharma
University of Southern California

Date submitted: 12 Aug 2016 Electronic form version 1.4