Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Numerical dosimetry of transcranial magnetic stimulation coils
LAWRENCE CROWTHER, RAVI HADIMANI, DAVID JILES, Iowa State University — Transcranial magnetic stimulation (TMS) is a non-invasive neuromodulation technique capable of stimulating neurons by means of electromagnetic induction. TMS can be used to map brain function and shows promise for the diagnosis and treatment of neurological and psychiatric disorders. Calculation of fields induced in the brain are necessary to accurately identify stimulated neural tissue during TMS. This allows the development of novel TMS coil designs capable of stimulating deeper brain regions and increasing the localization of stimulation that can be achieved. We have performed numerical calculations of magnetic and electric field with high-resolution anatomically realistic human head models to find these stimulated brain regions for a variety of proposed TMS coil designs. The realistic head models contain heterogeneous tissue structures and electrical conductivities, yielding superior results to those obtained from the simplified homogeneous head models that are commonly employed. The attenuation of electric field as a function of depth in the brain and the localization of stimulating field have been methodically investigated. In addition to providing a quantitative comparison of different TMS coil designs the variation of induced field between subjects has been investigated. We also show the differences in induced fields between adult, adolescent and child head models to preemptively identify potential safety issues in the application of pediatric TMS.

Lawrence Crowther
Iowa State University

Date submitted: 15 Nov 2013 Electronic form version 1.4