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Computation of high order fringe field effects in spectrographs, G. H. HOFFSTÄTTER, NSCL / Michigan State University[1] – For optical elements in general and for large acceptance spectrographs in particular, fringe fields often have a significant influence on optical properties. Especially higher order aberrations are often dominated by fringe field effects. In the last years the DA method has enabled very quick computation of high order maps in the main field region of particle optical elements by evaluation of the propagation operator. A high order transfer map of the fringe field region, however, can only be calculated accurately using rather time consuming numerical integration. Any approximate calculation scheme has to be accurate but fast to allow efficient optimization of field parameters. It should work to arbitrary order and should not violate the symplecticity relations between aberration coefficients, which can be crucial for aberration correction by symmetric arrangements of one pass systems and is essential for the motion in rings. A fast, accurate, symplectic method to approximate fringe field maps of magnetic elements will be introduced. It is particularly suited for the optimization process since the speed and accuracy are most advantageous when fringe field maps are computed repeatedly with slightly different parameters. The approximation exploits the advantages of Lie transformations, generating functions, scaling of the map with field strength and aperture, and the dependence of transfer maps on the ratio of magnetic rigidity to magnetic field strength. The advantages in speed and accuracy will be demonstrated by comparison to numerical integration and to several conventional fringe field approximations. The quality and usefulness of the method will be illustrated on some examples including the

[1]Part of a dissertation prepared at the Department of Physics at Michigan State University

design and sensitivity analysis of spectrographs and the computation of an accurate inverse map for the innovative reconstruction mode. The necessity of the symplectic structure will be illustrated by examples of repetitive tracking.