Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Chemical Nonlinearities and Radical Pair Lifetime Estimation
GREGORY ROBINSON, University of Colorado Boulder — Much attention has recently developed around chemical reactions that depend on applied static magnetic fields as weak as earth's. This interest is largely motivated by experiments that implicate the role of spin-selective radical pair recombination in biological magnetic sensing. Existing literature uses a straightforward calculation to approximate the expected lifetime of coherent radical pairs as a function of the minimum RF amplitude that is observed to disrupt magnetic navigation, apparently by decohering the radical pair via electronic Zeeman excitations. But we show that chemical nonlinearities can preclude direct computation of coherent pair lifetime without considering the cellular signalling mechanisms involved, and discuss whether it can explain the surprising fragility of some animals' compass sense. In particular, we demonstrate that an autocatalytic cycle can introduce threshold effects on the disruption sensitivity to applied oscillatory magnetic fields. We will show examples in the mean-field limit and consider the consequences of noise and fluctuations in the Freidlin-Wentzell picture of perturbed dynamical systems.

Gregory Robinson
University of Colorado Boulder

Date submitted: 11 Dec 2012 Electronic form version 1.4