Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Inter- and intracellular signaling induced by magnetomechanical actuation of plasma membrane channels ELINA A. VITOL, Argonne National Laboratory, Materials Science Division and Center for Nanoscale Materials, ELENA A. ROZHKOVA, Argonne National Laboratory, Center for Nanoscale Materials, VALENTYN NOVOSAD, Argonne National Laboratory, Materials Science Division, SAMUEL D. BADER, Argonne National Laboratory, Materials Science Division and Center for Nanoscale Materials — Magnetic particles allow for non-invasive control over their spatial orientation and motion which makes them ideally suitable for studying real-time processes in living cells. Lithographically defined ferromagnetic disks with spin-vortex ground state have the advantage of zero net magnetization in remanence. This eliminates long-range magnetic forces which otherwise lead to the interaction between particles and their agglomeration. Moreover, magnetically soft permalloy particles have high magnetization of saturation thus requiring very low external field for inducing high magnetomotive force, compared to superparamagnetic particles. Our group has previously demonstrated that micron-sized permalloy disks can be used for destruction of cancer cells (D.-H. Kim, E. A. Rozhkova, I. V. Ulasov, S. D. Bader, T. Rajh, M. S. Lesniak, V. Novosad, Nat. Mater. 9, 165-171 (2010). In this work, we investigate the effects of magnetomechanical stimulation of human brain cancer cells with these particles. It will be shown that the actuation of ion channels in cell plasma membrane induces, on the one hand side, intracellular signaling triggering cell apoptosis and, on the other hand, it stimulates the energy transfer between the cells which carries the information about apoptotic signal.

Elina A. Vitol
Argonne National Laboratory

Date submitted: 12 Nov 2011 Electronic form version 1.4