## Abstract Submitted for the MAR13 Meeting of The American Physical Society

Detection of low-concentration superparamagnetic nanoparticles using a functional biosensor based on magneto-impedance technology<sup>1</sup> JAGANNATH DEVKOTA, ALEJANDRO RUIZ, PRITISH MUKHERJEE, HAR-IHARAN SRIKANTH, MANH-HUONG PHAN, Department of Physics, University of South Florida, CHUNYAN WANG, SUBHRA MOHAPATRA, Department of Internal Medicine, University of South Florida — Improving the sensitivity of existing magnetic biosensors for detection of magnetic nanoparticles as biomarkers in biological systems is an important and challenging task. Here we demonstrate the possibility of combining the magneto-resistance (MR), magneto-reactance (MX), and magneto-impedance (MI) effects to develop a functional magnetic biosensor with tunable and enhanced sensitivity. A systematic study of the  $7 \text{ nm Fe}_{3}O_{4}$  nanoparticle concentration dependence of MR, MX, and MI ratios of a soft ferromagnetic amorphous ribbon shows that these ratios first increase sharply with increase in particle concentration (0 - 124 nM) and then become unchanged for higher concentrations (>124 nM). This points to the sensitivity and limit of the detection of the biosensor. The MX-based biosensor shows the highest sensitivity. With this sensor,  $2.1 \times 10^{11}$ 7 nm Fe<sub>3</sub>O<sub>4</sub> nanoparticles can be detected over a detection area of  $2.0 \times 10^5 \,\mu\text{m}^2$ , which is comparable to a SQUID biosensor that detects the presence of  $1 \times 10^8 \, 11$ nm Fe<sub>3</sub>O<sub>4</sub> nanoparticles over a detection area of  $6.8 \times 10^4 \,\mu\text{m}^2$ .

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