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Simulating Transport of Magnetic Microparticles on Disk Array Traps[1] ELIZA HOWARD, GREGORY VIEIRA, DUNG HOANG, RYAN SIMMS, DAVID RAYMOND, EDWARD CULLOM, Rhodes College — The manipulation of superparamagnetic microparticles, or beads, by applying controlled, tunable forces without direct external contact has applications in sorting and purifying heterogeneous liquid samples, useful for biology and chemistry, and can be used as components for lab-on-chip devices. This can be accomplished by using an array of magnetic traps. In our set-up, the beads are moved by applying and varying external magnetic fields to create and rotate magnetic traps around the periphery of permalloy disks. We created a computer simulation using Python which replicates bead motion and therefore helps provide a better understanding of the phenomena we observe, as well as the magnetic properties of the disks and beads. Using short-range motion, the repulsion of a bead from one disk to the next, we fit the simulation's predictions to experimental results and determined parameters for bead magnetic susceptibility and the strength of the magnetic fields from the disks. The simulation successfully replicates and predicts phenomena such as the path a bead takes as it travels, limitations on bead speed, and the correlation between various parameters, such as bead radius or external magnetic field, and bead motion.

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