

Minimizing the Free Energy of “Metallic” Spheres in ER Fluids Continued II

This past summer, my mentor and I worked toward the goal of finding the energy minimization of “metallic” spheres. Some of the specific avenues that we focused on were as follows:

- Learning the background of the Ising Model.
- Examining the effect of the configurational geometry on the values of the free energy.
- Modifying the computer program to take into consideration physical boundary conditions.

- Studying how the ground states depend on s which is equal to $\frac{1}{1 - \frac{\epsilon_1}{\epsilon_2}}$

where ϵ_1 is the constituent complex permittivity of the “metal” spheres and ϵ_2 is the constituent complex permittivity of the oil.

This semester, Fall 2006, our main focus will be to investigate the role of the Yang-Lee Theorem in the Ising Model of Statistical Mechanics. We'll study the derivation of the Hamiltonian of the system to the Partition Function and from there see how this can give us a function for the Free Energy of the system. From an integral representation of the free energy, we can find the magnetization or the effective conductivity of the system. With these factors and the use of a computer program, we can hopefully better understand the characteristics of configurations which minimize the free energy of the system.