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**Magnetic nanoparticles in fluids: aggregation and its affect on biomedical applications**

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Magnetic nanoparticles are attracted or repelled from one another due to dipolar interactions. In zero applied field and when they are placed in a fluid, they aggregate and form small rings or long chains. In applied fields, chains predominate as these minimize the magnetic energy. Biomedical applications of such systems include: magnetic hyperthermia (killing disease with heat when an alternating kHz field is applied), MRI contrast agents, and guided drug delivery. Most theoretical models of these applications consider isolated magnetic particles, although there is evidence that they aggregate. The question then is: how does this aggregation affect the effectiveness of biomedical treatments involving magnetic nanoparticles? We have built a molecular dynamics simulation to calculate how the shape and net magnetization of aggregates changes as fields are applied. Random forces due to finite temperature buffeting of the particles must be included. In particular, we aim to calculate the amount of heat that can be produced in hyperthermia treatments. The shape of aggregates substantially alters the amount of heat that is produced by a constant number of magnetic nanoparticles. The thermal energy may be either increased or decreased compared to the output from isolated magnetic particles.