Objective:
- Establish a method to accurately and efficiently determine the heating of a solution of magnetic nanoparticles
- Devise a process that allows for certain nanoparticle magnetic properties to be calculated
- Compare conventional magnetometer data to magnetic induced heating data

Instrumentation:
1. Magnetherm – coil/capacitor produces magnetic field
2. Oscilloscope – shows peak-to-peak voltage of A/C field
3. Function Generator – oscillates magnetic field
4. Power Supply – provides voltage and current to Magnetherm
5. DAQ assistant with thermocouples – reads temperature from sample and sends data to Origin

Results:
Magnetite (Fe₃O₄) nanoparticles

Theoretical Calculation of Magnetic Moment Per Particle
\[ V_{nanoparticle} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(7.5)^3 = 1767.15 \text{ nm}^3 \]
\[ V_{unit cell} = 0.819^3 = 0.5906 \text{ nm}^3 \] (Magnetite Fe₂O₃) \[ \frac{32 \mu g}{\text{unit cell}} \]
\[ V_{nanoparticle} = 2992.13 \text{ unit cells per particle} \]
\[ \mu = 32 \cdot \mu_B \cdot (2992.13) = 3.88 \times 10^{-19} \text{ } \mu_B \]

Conclusions:
- Highly monodisperse magnetite nanoparticles from Ocean Nanotech (diameter = 15 nm) were used in this study
- The magnetic moment per particle in each method was comparable, which proves the validity of the Linear Response Theory for magnetic nanoparticles
- Unprecedented comparison between magnetic induced heating and SQUID
- Magnetic induced heating is an efficient and cost effective alternative to the SQUID for measurements of magnetic moment per particle

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