

ND*nano* Undergraduate Research Fellowship (NURF) 2011 Project Summary

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Project title: Development of laser transmission spectroscopy as a PCR free DNA detection device

My work this summer involved the analysis of nanoparticles in solution using the new technique of Laser Transmission spectroscopy. For my work three types of particles were involved, which were associated with different scientific goals. The size scale for the particles was from 1 to 3000 nm. The first class of particles was magnetic nanobeads. These beads are used for a variety of purposes including magnetic separation of target molecules and the enhancement of MRI signals in the body. Magnetic particles and magnetic particles with proteins attached are very small (~ 3 – 5 nm) and tend to agglomerate. Because of this and their intrinsic small size, traditional light-scattering techniques are not able to provide reliable information on these materials. I showed in my work that we could measure the size and density of magnetoferritin, apoferritin, and magnetite particles with unprecedented resolution.

Other work involved species-specific DNA detection. Here we used functionalized polystyrene nanobeads with DNA tags to detect target DNA. The work involved establishing both the absolute sensitivity of the detection methodology and its specificity with regard to how many base-pairs differences are required to distinguish one DNA strain from another. Finally, I looked at virus-like proteins (VLPs). These are proteins that behave much like the specific viruses they're associated with. Studying VLPs can give information about the viral capsid, or the protein shell that surrounds the virus.

Using our LTS technology, we can take measurements that give the number of objects in solution that present as separate nanoparticles (nanobeads or other materials), and the diameter distribution of the nanoparticles. For the materials associated with these studies, useful information was not previously available due to the limited resolution of other diagnostic techniques, and/or their ability to provide density-distribution information.