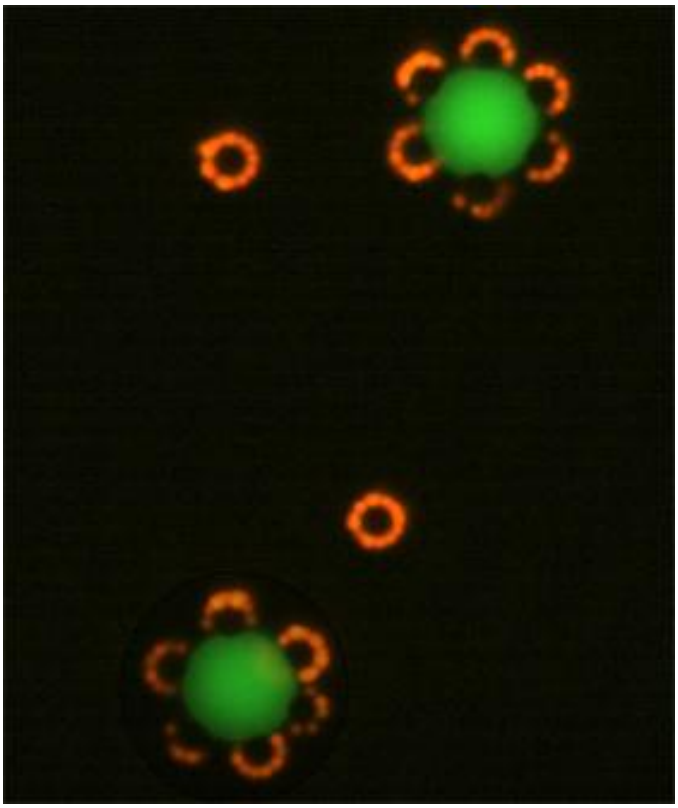
Guided Self-assembling of Nanostructures Using Magnetic Fluids

Ferrofluids are colloidal mixtures of iron-containing nanoparticles suspended in a liquid. These fluids become highly magnetized in the presence of external magnetic fields. By manipulating the magnetization of ferrofluids, researchers led by Benjamin Yellen at Duke University have for the first time created complex nanostructures that combine magnetic and non-magnetic materials. Researchers were then able to lock the intricate structures together, even in the absence of a magnetic field. This raises the possibility of using these structures in optical devices such as sensors, cloaking devices, antennas, and data storage, and for bioengineering.

Colleagues at the University of Massachusetts developed unique ferrofluids with various nanoparticle concentrations, degrees of magnetism, sizes, and types for the Duke experiments. By applying a uniform magnetic field to the different ferrofluids, the Duke team was able to control how the nanoparticles attract or repel one other. Tuning these interactions prompted the magnetic and non-magnetic particles to self-assemble into sophisticated shapes. Yellen's group plans to experiment with additional ferrofluids to create new and smaller nanostructures, explore their optical properties, and find ways to scale up the self-assembly process.



Uniform clusters of micron-scaled particles assembled by magnetism. Credit: Benjamin Yellen lab, Pratt School of Engineering, Duke University.

Erb, R. M., H. S. Son, B. Samanta, V. M. Rotello, and B. B. Yellen. 2009. Magnetic assembly of colloidal superstructures with multipole symmetry. *Nature* **457**: 999–1002. doi:10.1038/nature07766

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