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Research Highlights

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Subject Category: Nanomagnetism and spintronics

Magnetism: Lighting the way

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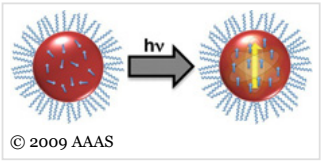
Strong control over the magnetic state of a solution-processed quantum dot doped with magnetic impurities is demonstrated.



Light is an attractively simple way to control the spin state of a material for spintronic applications. Recently, researchers have demonstrated control over the magnetism of a solution-processed quantum dot doped with a small amount of magnetic impurities[1]. In this case, light-induced charges affected the interactions of the impurities with each other, even at room temperature. Previous work has used the interaction of light-induced charges with the impurities themselves — an approach called dopant–carrier exchange. However, so far this has yielded results only at cryogenic temperatures, and the impurity spins have completely aligned only in the presence of strong magnetic fields.

Now, Daniel Gamelin and colleagues at the University of Washington have shown that dopant–carrier exchange can cause the magnetic-impurity spins in a quantum dot to completely align even without any applied magnetic field, and at temperatures up to 50 K (ref. 2). The key is the tight localization of the light-induced excited states, and avoiding unwanted energy transfer out of these states by carefully tuning their energies. From their data, the researchers calculate the effective magnetic field acting on the magnetic impurities to be 75 T, an order of magnitude greater than previously achieved.

These demonstrations of optical spin manipulation in solution-processed quantum dots enhance the prospects of spin-coat-processed or self-assembled devices for spintronic applications.

References

1. Ochsenbein *et al.* Charge-controlled magnetism in colloidal doped semiconductor nanocrystals. *Nature Nanotech.* doi:10.1038/nnano.2009.221 (2009). | **Article**
2. Beaulac, R., Schneider, L., Archer, P. I., Bacher, G. & Gamelin, D. R. Light-induced spontaneous magnetization in doped colloidal quantum dots. *Science* **325**, 973–976 (2009). | **Article** | **PubMed** | **ChemPort** |

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