Tunable Magnetic Exchange Interactions in Mn-doped ZnSe/CdSe Core/Shell Nanocrystal Quantum Dots

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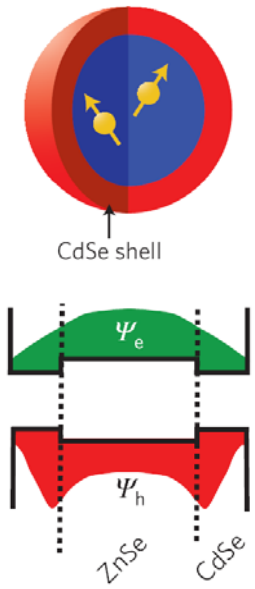
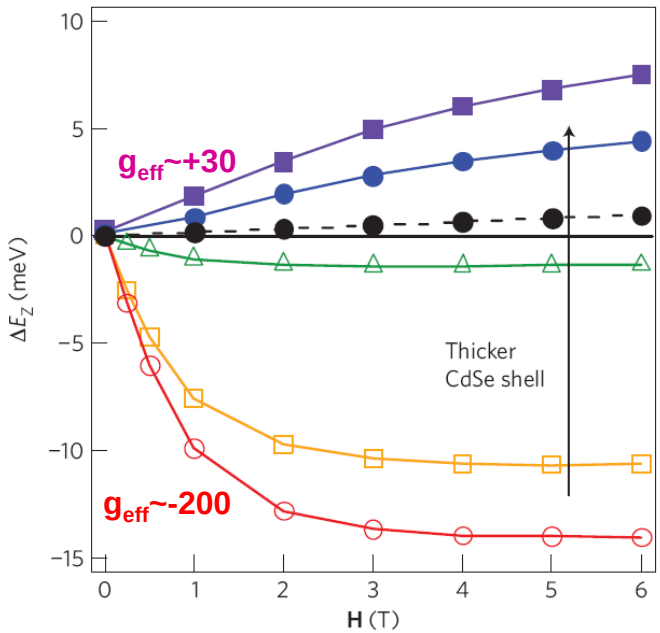
- We realize a tunable $J_{sp\text{-}d}$ magnetic exchange interaction between electron-hole pairs (excitons) in a semiconductor nanocrystal and magnetic (spin-5/2) Mn atoms that are also doped into the nanocrystal.





- Low-temperature optical studies of magnetic-circular dichroism reveals giant Zeeman splittings between the spin +-1 band-edge excitons that, surprisingly, are tunable in both magnitude *and sign.*

- Effective exciton *g*-factors are controllably tuned from -200 to +30 solely by increasing the CdSe shell thickness, demonstrating that strong quantum confinement and wavefunction engineering in core/shell nanocrystal materials can be used to manipulate carrier–Mn2+ wavefunction overlap and the *sp-d* exchange parameters themselves.

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