



Spin-polarized Mn emission from Mn-doped nanocrystals

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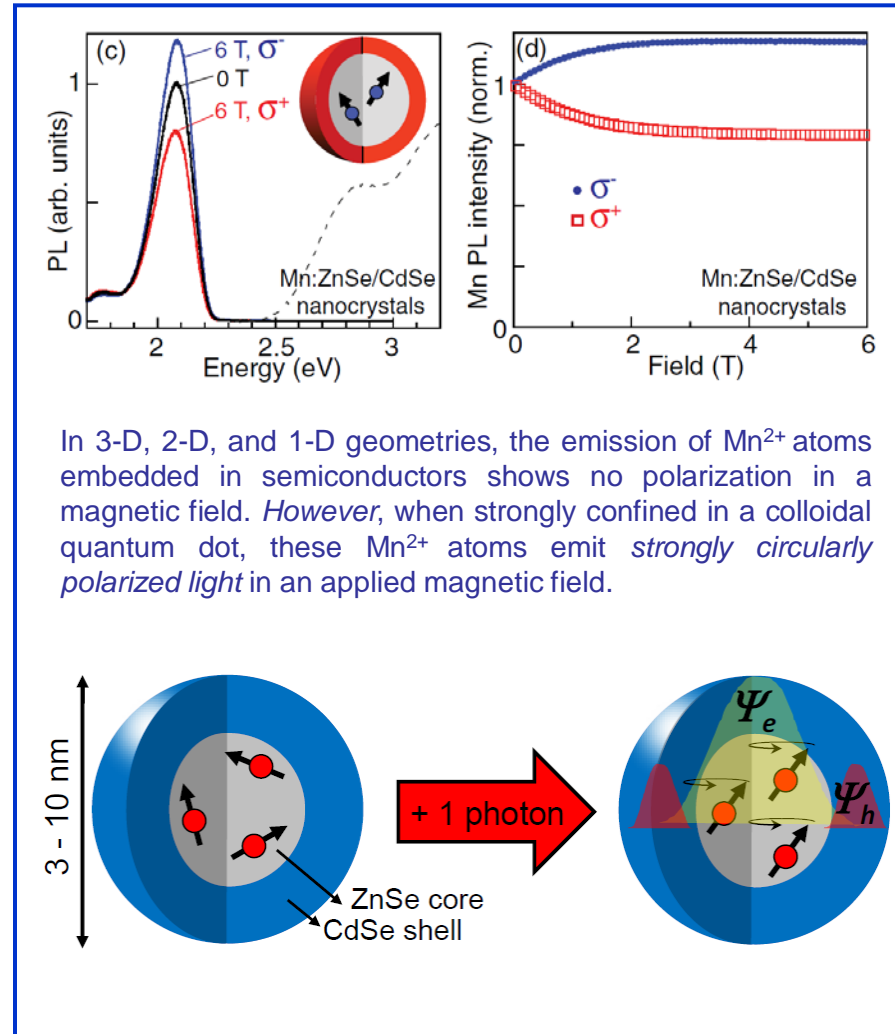


The coupling between band electrons and local magnetic moments underpins many phenomena in condensed matter physics. The additional influence of *strong quantum confinement* can enhance these fundamental interactions, leading to new and emergent properties in nano-materials.

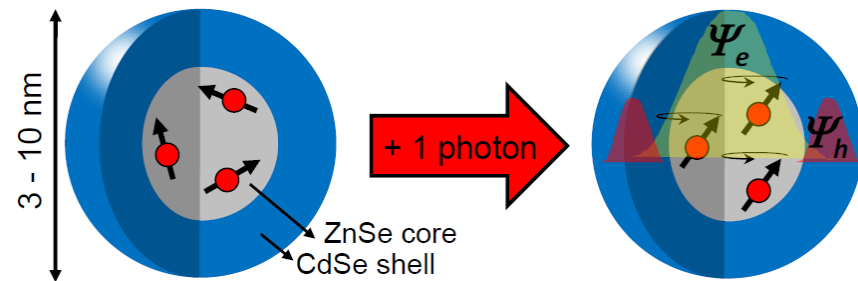
We show that -- in contrast to their 3D (bulk), 2D (quantum well), or 1D (quantum wire) counterparts -- confinement of Mn atoms in 0D colloidal nanocrystals drastically modifies the magneto-optical properties of the Mn atoms themselves (see figure). These data highlight the critical role of *strong quantum confinement* on both the excitation and emission properties of magnetic atoms embedded in nano-materials.

This work heralds new classes of engineered magnetic semiconductor nanomaterials having *broadly tunable magnetic exchange interactions*.

Using *core-shell nanoparticle synthesis* and *controlled radial placement of magnetic atoms*, we can engineer the wavefunction of electrons (and holes) and their all-important overlap with the magnetic atoms, which leads to tunable magnetic and magneto-optical properties.



In 3-D, 2-D, and 1-D geometries, the emission of Mn^{2+} atoms embedded in semiconductors shows no polarization in a magnetic field. *However*, when strongly confined in a colloidal quantum dot, these Mn^{2+} atoms emit *strongly circularly polarized light* in an applied magnetic field.



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