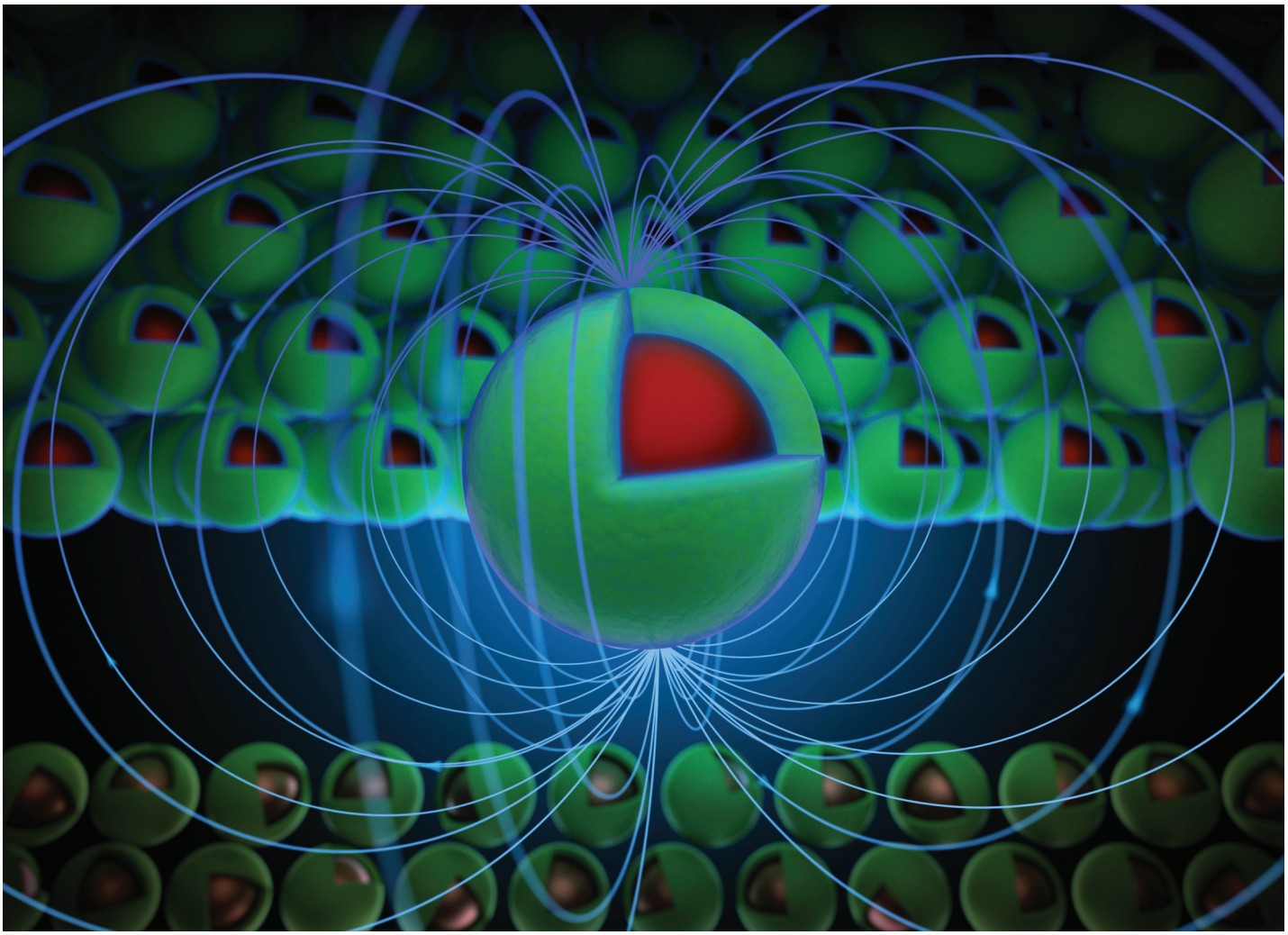

Showcasing research from Critical Materials Institute at Lawrence Livermore National Laboratory, Livermore, California, U.S.A.

Probing strongly exchange coupled magnetic behaviors in soft/hard Ni/$CoFe_2O_4$ core/shell nanoparticles

Exchange coupling in a model core–shell system is demonstrated as a step on the path to 3D exchange spring magnets. Employing a model system of Ni@$CoFe_2O_4$, high quality core–shell nanoparticles were successfully fabricated, demonstrating two-phase magnetic behavior and a transition to coherent reversal of core and shell at lower temperatures. Element-specific XMCD hysteresis confirms that the core and shell display strong coupling, as well as the suppression of superparamagnetism at room temperature in the cores. These results provide a pathway to the development of heterostructured metal-oxide exchange coupled nanoparticles with improved maximum energy product.

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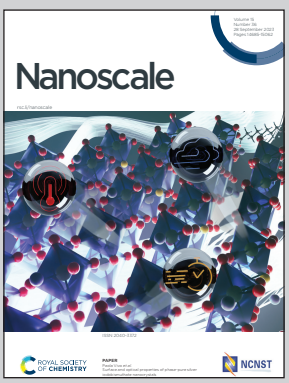

See J. K. Han *et al.*, *Nanoscale*, 2023, **15**, 14782.

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