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Intrinsic magnetism in nonmagnetic nanostructures: Role of localized states and quantum confinement.[1]

PEIHONG ZHANG, University at Buffalo, SUNY

Manipulation of carrier spins in semiconductors for spintronics applications has received much attention recently driven by the promise of new or improved functionalities. This has stimulated extensive research in the area of magnetic semiconductors. Magnetism is traditionally recognized as arising from unpaired electrons in 3d and 4f materials. However, there has been increasing evidence that localized defect states (and/or surface/edge states) in sp materials, especially in some nanostructures, may form local moments and exhibit collective magnetism. In a recent paper [PRL100, 117204 (2008)], we proposed that the duality (i.e., localized vs extended nature) of defect states in wide-gap nitrides and oxides may promote collective magnetism in these materials without magnetic ions. We have recently extended this study to include unexpected magnetism observed in GaN and ZnO nanowires and other artificial quantum structures. Particular attention will be paid to the role of localized states and quantum confinement in promoting unconventional magnetism in these systems.

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