Quantum confinement: A route to enhance the Curie temperature of Mn doped GaAs

Priya Mahadevan
S.N. Bose National Centre for Basic Sciences, Kolkata

Bulk transition metal compounds have been studied for a long time and their electronic structure is well established within the framework of the Zaanen-Sawatzky-Allen (ZSA) phase diagram and its variants. A similar framework should be possible for dilute magnetic semiconductors which we examine in the present work. We consider a multiband Hubbard model to describe the electronic structure of the dilute magnetic semiconductors with Coulomb interactions included on the transition metal site. Parameters appropriate for Mn doped GaAs place it in the regime of a p-d metal of the ZSA phase diagram, thereby explaining why correlation effects don't drive it insulating [1]. Quantum confinement effects can be used to tune the charge transfer energy Δ, driving a change in the character of the hole state. We show that this also serves as a parameter to change the Curie temperature. Confinement arising from the presence of the surface could lead to the same effect of enhancing the Curie temperature.

[1]. B. Mandal, H.K. Chandra, Poonam Kumari and Priya Mahadevan, Phys. Rev. B **96**, 014430 (2017).