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Double exchange model and magnetic polarons in Eu-based hexaborides

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In this presentation, important details of the Double Exchange model at low densities and their pertinence to the physics of ferromagnetic hexaborides will be addressed. After a brief survey of some key experiments and signatures of these compounds, it will be shown that in such systems, where itinerant electrons at extremely reduced densities interact with a dense local spin subsystem, effects of Anderson localization are paramount, providing a consistent picture of the remarkable and unusual response of materials like $Eu_{1-x}Ca_xB_6$ in magnetic, optical and transport measurements. In this context we will show how one can understand the blue shift in the plasma frequency, the enhancement of carrier density and the CMR effect upon entering the ferromagnetic phase of EuB_6 as effects stemming from Anderson localization mechanisms. We will provide an interpretation for the metal insulator transition that occurs upon doping, under the light of recent magneto-optical experiments. In addition, the region of stability of magnetic polarons in the low density Double Exchange Model is discussed, and shown to be consistent with experimental hints of a polaronic phase mediating the PM-FM transition in the vicinity of T_C.