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Disorder and many-body effects in transport and optical conductivities of diluted magnetic semiconductors[1] FEDIR KYRYCHENKO, CARSTEN A. ULLRICH, Department of Physics University of Missouri - Columbia
— The nature of itinerant carriers in diluted magnetic semiconductors like GaMnAs is a subject of intense current debate. The valence-band picture has been widely used, but recent experimental results suggest that the carriers reside in impurity bands. Theoretical results have not been fully conclusive. Most studies within the valence-band picture treat band structures in detail, while disorder and many-body effects are only treated with simple relaxation time and static screening models. We present a more complete theory for electron dynamics in DMSs, combining a multi-band $\mathbf{k} \cdot \mathbf{p}$ approach with first-principle descriptions of disorder and many- body effects through the memory function formalism and time- dependent density functional theory. This allows us to capture dynamic screening and collective electronic excitations of the itinerant carriers as well as correlations between impurities. We calculate transport properties and optical conductivities for GaMnAs and compare with experimental results.

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