Magneto-optical properties of metallic (III,Mn)V magnetic semiconductors

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Metallic diluted magnetic semiconductors (DMS's) materials offer a much wider spectrum of magneto-transport and magneto-optic effects than conventional itinerant electron ferromagnets, mostly due to the greater tunnability of the Mn moments ordered state through growth conditions, doping, gates, and light. The magneto-optical effects have not been explored as intensely as its transport counterpart in spite of the obvious potential for novel physical behavior and more precise characterization of the underlying physics. Here we study the infrared magneto-optical properties together with some thermodynamic and transport properties of (III,Mn)V semiconductors based on the itinerant hole-fluid model. Within this phenomenological approach we consider the virtual crystal approximation, applicable to the cleaner metallic samples, including disorder scattering within a Bohrn type approximation, and a finite size self-consistent calculation where disorder and interactions are treated in an equal footing. We will discuss the different results and predictions of these calculations. We also demonstrate the possibility of using optical absorption as a tool to measure the itinerant carrier density.