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Hole spin relaxation in diluted magnetic semiconductors[1]
YONGKE SUN, FEDIR KYRYCHENKO, GARY SANDERS, CHRISTOPHER STANTON, Department of Physics, University of Florida — Diluted Magnetic Semiconductors are postulated to serve as efficient spin injectors for various spintronic applications. Hence, a detailed theoretical investigation of carrier spin dynamics in these materials is of particular importance. The introduction of Mn ions influences the itinerant carrier spin dynamics in many ways. First, the orbital scattering of the itinerant carriers with the Mn impurities can affect spin relaxation through Elliot-Yaffet and/or Dyakonov-Perel' mechanisms. Secondly, the diagonal part of exchange interaction results in the large spin splitting of energy bands. Finally, the off-diagonal part of the carrier-magnetic ion exchange interaction forms an additional channel of spin relaxation. In this work we theoretically investigate the hole spin dynamics in III, Mn-V bulk semiconductors such as InMnAs or GaMnAs. We study the changes in spin-relaxation with the increase of Mn concentration. In our model we take into account the valence band complexity and treat the exchange interaction within the mean field approximation. We consider the Elliot-Yafet spin relaxation mechanism for impurity and phonon scattering. Results of our calculations are compared with experiment.

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Yongke Sun
Department of Physics, University of Florida

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