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Low-temperature and strained-lattice effects on Monte Carlo modeling of spin-polarized photoemission from GaAs

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The degree of spin-polarization of electrons photoemitted from unstrained, room-temperature GaAs is usually significantly less than the theoretical maximum of 50%. However, it has been experimentally observed that the degree of electron spin polarization can be increased and even exceed the theoretical maximum when the sample is cooled to low temperatures and in strained-lattice samples. The previously developed Monte Carlo approach to spin-polarized photoemission from unstrained, room temperature NEA GaAs provides excellent agreement with experimental data in a wide range of doping densities and photoexcitation energies. This work aims to extend the model's capabilities by incorporating both low-temperature and strained-lattice effects into the band structure and investigating their impact on spin and momentum relaxation mechanisms. Modeling of both low-temperature and strained NEA GaAs with the use of parameters obtained via Density Functional Theory (DFT) calculations will provide a foundation for modeling photoemission from novel spin-polarized materials and complex layered structures and aid in the discovery of new cathode materials.

Footnotes

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