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Magnetization dynamics under electromagnetic fields in the wavepacket methods. BANGGUO XIONG, HUA CHEN, XIAO LI, Univ of Texas, Austin, QIAN NIU, Univ of Texas, Austin;ICQM, PKU — In this work we try to understand the magnetization dynamics in magnetic materials with electrons described by the semiclasscial wavepacket methods. Using the Lagrangian of electron wavepackets under slowly varying magnetization, we can explicitly write down the dynamic equations for both electrons and magnetization order, where the mutual interplay between the two presents itself naturally. It turns out that, more general than LLG equation, the magnetization dynamics is written as a first order differential equation as for a general vector, which allows a detailed discussion on physical process studied before, such as spin transfer torque, spin orbital torque and damping mechanism, and also gives the vortex-like torques that can pump energy into the system. Since electrons are easy to control by electromagnetic fields, we expect a theory that electromagnetic fields through coupling to electrons can be used to manipulate the magnetization. It is interesting that this formalism on magnetization dynamics can be used to study the electromagnetic response of bulk electrons, from which the current and magnetization expressions are extracted that match well with previous studies.

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