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Gauge fields, the Berry phase, motive forces and the dynamics of domain walls etc. STEWART BARNES, Physics Dept., Univ. of Miami, JUNICHI IEDA, SADAMICHI MAEKAWA, IMR, Tohoku University — The theory of the dynamics of domain walls and spin valves is described within the Stoner model. Using principally domain walls as examples, to be outlined are issues which arise from the requirements of energy conservation and the nature of relaxation within such a simple model. While they are not currently common currency for those working in this field, emphasized are the importance of certain vector potentials which reflect angular momentum transfer and energy conservation and which lie beyond the traditional single electron approach to this simplest model. The (majority/minority electron) spin derived forces $\vec{f}_s^{\pm}$ which arise from such dynamics are given by

$$\vec{f}_s^{\pm} = -\frac{\hbar}{2}\frac{\partial \vec{A}_s^{\pm}}{\partial t} - \vec{\nabla}_{\vec{r}}\varphi_s^{\pm}. \tag{1}$$

where the vector potential $\vec{A}_s^{\pm}$, introduced here, reflects the Berry phase and corresponds to a "no name" non-conservative spin forces. The *usual* "Stern-Gerlach" forces correspond to the second term. This and a second gauge field $\vec{A}_s^t$ are required if the dynamical version of the Stoner theory is to conserve energy and angular momentum. The effects are *not* small and have significant experimental consequences and device applications.

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