

Supercurrent and electromotive force generations by the Berry connection from many-body wave functions

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Faraday's law for the electromotive force (EMF) generation is given by the following formula,

$$\mathcal{E} = -\frac{d}{dt} \int_S \mathbf{B} \cdot d\mathbf{S}$$

where \mathbf{B} is the magnetic field.

We obtained a similar formula for the 'fictitious magnetic field' generated by the Berry connection,

$$\mathcal{E}^{\text{MB}} = -\frac{\hbar}{e} \frac{d}{dt} \int_S \mathbf{B}^{\text{MB}} \cdot d\mathbf{S}$$

where $\mathbf{B}^{\text{MB}} = \nabla \times \mathbf{A}^{\text{MB}}$ is the 'fictitious magnetic field' from the Berry connection \mathbf{A}^{MB} .

An example calculation for the EMF from the above formula is performed for the Nernst effect observed in the high temperature cuprate superconductor.

Implications for other phenomena will be discussed.

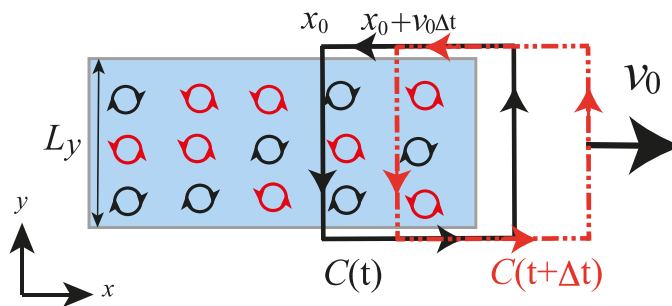


Figure caption: A schematic picture for the EMF appearing from the Berry connection generated by spin-vortices in a model for the cuprate superconductor.