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Generalization of the Peierls phase for gauge-invariant Green functions SYLVIA D. SWIECICKI, J.E. SIPE, University of Toronto — Solids in time-varying fields can be characterized with the non-equilibrium Green function formalism. If the interaction is described through potentials, the identification of sum rules is necessary to remove unphysical divergences that can appear in low frequency response calculations. For isolated atoms divergences are avoided by moving to a gauge-invariant Hamiltonian with the Power-Zienau-Woolley transformation.[1] For solids, a gauge-invariant Green function formalism was proposed by Levanda and Fleurov[2]; in the generalization of the Peierls phase they introduced they consider only straight lines in spacetime. We extend this work to arbitrary paths in spacetime and show that the results for isolated atoms can be derived as a special case. More general applications are considered.

[1]W. Healy, Non-relativistic quantum electrodynamics (1982)
[2]M. Levanda, V. Fleurov, J. Phys: Cond. Matt. **6** (1994) 7889

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