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Gyrotropic magnetic effects in chiral metals IVO SOUZA, Universidad del Pais Vasco, San Sebastian, SHUDAN ZHONG, University of California, Berkeley, DAVID VANDERBILT, Rutgers University, JOEL MOORE, University of California, Berkeley — We consider two conjugate transport effects occuring in chiral metals as the low-frequency limit of natural optical activity (optical gyrotropy). One occurs in the clean limit where ω is small compared to the minimum energy for interband transitions, but large compared to the scattering rate $1/\tau$. It consists of a dissipationless current induced by a magnetic field, $J_i = \alpha'_{ij} B_j$, and is different from the chiral magnetic effect requiring a static $\mathbf{B}$ and an electric-field pulse $\mathbf{E} \parallel \mathbf{B}$. In the inverse effect a magnetization is generated by a dissipative current, $M_i = (1/\omega)\alpha''_{ji} E_j$, with $\mathbf{E}$ the field driving the current and $\omega \ll 1/\tau$, as discussed by Yoda *et al.*, Sci. Rep. **5**, 12024 (2015). The low-frequency gyrotropic responses α' and α'' in the clean and dirty limits can be combined into a complex tensor $\alpha = \alpha' + i\alpha''$ given by the Fermi-surface integral of the total (orbital plus spin) intrinsic magnetic moment of the Bloch electrons, with a prefactor proportional to $1 - i\omega\tau$. Without spin-orbit coupling, only the orbital moment contributes.

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