A Dirac semimetal (purple) hosts both left-handed (LH)- and right-handed (RH)-fermions on the same band. A Weyl semimetal (blue and orange) hosts LH- and RH-fermions on separate bands. (b) The definition of chirality in relativistic quantum field theory. Chiral qubits have two base states describing chiral fermions circulating clockwise and counter-clockwise. (d) The chiral anomaly is manifested, e.g., as the chiral magnetic effect – generation of an electric current by external gauge fields with non-trivial topology (e.g. by parallel electric and magnetic fields) – The signature of the chiral magnetic effect is the negative longitudinal magnetoresistance first discovered in Dirac semimetal ZrTe$_5$ [Q. Li et al, arXiv:1412.6543 (2014); Nature Physics 12, 550 (2016).] (e) The chiral photovoltaic cell enables a production of electric current in a Weyl semimetal via circular photogalvanic effect. (f) Chiral transduction uses chirality as encoder/decoder in transmitting a message, and serves as a "quantum bus" between quantum devices operating at different frequencies.