

Majorana Fermion bilinears

- In terms of Weyl spinors: $\psi = \begin{pmatrix} \chi \\ \chi^\dagger \end{pmatrix}$ $\gamma^\mu = \begin{pmatrix} & \sigma^\mu \\ \bar{\sigma}^\mu & \end{pmatrix}$

$$\bar{\psi}\psi = \chi\chi + \chi^\dagger\chi^\dagger$$

$$\bar{\psi}\gamma_5\psi = -\chi\chi + \chi^\dagger\chi^\dagger$$

$$\bar{\psi}\gamma^\mu\psi = \chi^\dagger\bar{\sigma}^\mu\chi + \chi\bar{\sigma}^\mu\chi^\dagger \stackrel{*}{=} 0.$$

$$\bar{\psi}\gamma^\mu\gamma_5\psi = -\chi^\dagger\bar{\sigma}^\mu\chi + \chi\bar{\sigma}^\mu\chi^\dagger = -2\chi^\dagger\bar{\sigma}^\mu\chi$$

$$\bar{\psi}\sigma^{\mu\nu}\psi = \frac{i}{2}\chi(\sigma^\mu\bar{\sigma}^\nu - \sigma^\nu\bar{\sigma}^\mu)\chi + \frac{i}{2}\chi^\dagger(\bar{\sigma}^\mu\sigma^\nu - \bar{\sigma}^\nu\sigma^\mu)\chi^\dagger \stackrel{*}{=} 0$$

$$\bar{\psi}\sigma^{\mu\nu}\gamma_5\psi = \frac{-i}{2}\chi(\sigma^\mu\bar{\sigma}^\nu - \sigma^\nu\bar{\sigma}^\mu)\chi + \frac{i}{2}\chi^\dagger(\bar{\sigma}^\mu\sigma^\nu - \bar{\sigma}^\nu\sigma^\mu)\chi^\dagger \stackrel{*}{=} 0$$

tensor and axial-tensor
* $\chi\sigma^\mu\bar{\sigma}^\nu\chi - \chi\sigma^\nu\bar{\sigma}^\mu\chi = 0.$

The vanishing of vector, tensor and axial-tensor bilinears implies Majorana fermions have no Dirac, Pauli, or EDM form factors
(charge) (magnetic moment)

* Transition form factors may exist