

Phy 523
PARTICLE PHYSICS- Problem sheet 3 3 3

27th January 2009

Due 3rd February 2009

Define $S(x) = \bar{\psi}(x)\psi(x)$; $P(x) = \bar{\psi}(x)\gamma_5\psi(x)$; $V_\mu(x) = \bar{\psi}(x)\gamma_\mu\psi(x)$; $A_\mu(x) = \bar{\psi}(x)\gamma_5\gamma_\mu\psi(x)$; $T_{\mu\nu}(x) = \bar{\psi}\sigma_{\mu\nu}\psi(x)$; where $\sigma_{\mu\nu} = i(\gamma_\mu\gamma_\nu - \gamma_\nu\gamma_\mu)/2$. Here $\psi(x), \bar{\psi}(x)$ are anticommuting fields.

11. Discuss how the above bilinears transform under a proper Lorentz transformation.

12. Discuss how the above quantities transform under parity.

13. Discuss how the above quantities transform under time reversal.

14. Discuss how the above quantities transform under charge conjugation.

15. Consider the reaction $\pi^- + d \rightarrow n + n$. It is given that the capture of π^- by deuteron occurs in the s-state ($l=0$). Show that $n + n$ can not be emitted in the s-state $l = 0$ state. Assuming that parity is conserved and that it is emitted in the p-state ($l = 1$), find the parity of π^- . (deuteron has spin 1 and is in the s-state ($l=0$); assume the intrinsic parity of proton and neutron is positive.)