$$A^2 = \left(c_0 \mathbb{1} + c_a T^a\right)^2 = c_0^2 \mathbb{1} + c_a c_b \left(T^a T^b + T^b T^a\right) + c_a^2 \left(T^a\right)^2$$

$$\mathrm{Tr} A^2 = c_0^2 + \sum c_a^2$$

$$\mathrm{Tr} A T^b = 0 + c_a \delta^{ab} = c_b$$

$$c_a = \mathrm{Tr}\left(A T^a\right) \qquad c_0$$

$$A = c_0 \hat{1} + \sum_a \mathrm{Tr}\left(A T^a\right) T^a$$

$$A_{ij} = \frac{1}{N} \mathrm{Tr} A \, \hat{1} +$$

$$A_{ij} = A_{kk} \delta_{ij} \delta_{kl} + T^a_{ij} T^a_{kl} A_{lk}$$

$$A = \frac{1}{N}\left(\mathrm{Tr} A\right) \hat{1} + T^a \, \mathrm{Tr}\left(A T^a\right)$$

$$A_{ij} = A_{kl} \delta_{ik} \delta_{jl} = \frac{1}{N} A_{kl} \delta_{ij} \delta_{kl} + T^a_{ij} A_{kl} T^a_{lk}$$

$$\boxed{T^a_{ij} T^a_{lk} = \delta_{ik} \delta_{jl} - \frac{1}{N} \delta_{ij} \delta_{kl}}$$

GORDON IDENTITY

$$\bar{u}(p_2)\left[\not{a}(\not{p}_1 - m) + (\not{p}_2 - m)\not{a}\right]u(p_1) = 0$$

$$\cancel{\not{p}_1\not{a}}$$

$$\not{a}\not{p}_1 + \not{p}_1\not{a} = 2p_1 a$$

$$\bar{u}(p_2)\left[2p_1^\mu - \cancel{\not{p}_1\not{a} - \not{a}\not{p}_2} - \not{p}_1\gamma^\mu - \gamma^\mu\not{p}_2 - 2m\gamma^\mu\right]u(p_1)$$

$$\gamma^\mu\gamma^\nu = \frac{1}{2}\{\gamma^\mu,\gamma^\nu\} + \frac{1}{2}[\gamma^\mu,\gamma^\nu] = g^{\mu\nu} - \frac{i}{2}\sigma^{\mu\nu}$$

$$\bar{u}\left[\gamma^\mu\gamma^\nu p_{1\nu} - 2m\gamma^\mu + \gamma^\nu\gamma^\mu p_{2\nu}\right]u = 0$$

$$\bar{u}\left[p_1^\mu + p_2^\mu - 2m\gamma^\mu - \frac{i}{2}\sigma^{\mu\nu}p_{1\nu} + \frac{i}{2}\sigma^{\mu\nu}p_{2\nu}\right]u = 0$$

$$2m\,\bar{u}\gamma^\mu u = \bar{u}\left[p_1^\mu + p_2^\mu + \frac{i}{2}\sigma^{\mu\nu}(p_2 - p_1)_\nu\right]u$$

$$\bar{u}\gamma^\mu u = \frac{1}{2m}\left[(p_1 + p_2)^\mu + \frac{i}{2}\sigma^{\mu\nu}(p_2 - p_1)_\nu\right]u$$

WITH γ_5

$$\bar{u}\left[\gamma^\mu\gamma_5(\not{p}_1 - m) + (\not{p}_2 - m)\gamma^\mu\gamma_5\right]u = 0$$

$$\bar{u}\left[-2m\gamma^\mu\gamma_5 + p_{2\nu}\left(g^{\mu\nu} + \frac{i}{2}\sigma^{\mu\nu}\right)\gamma_5 - p_{1\nu}\left(g^{\mu\nu} - \frac{i}{2}\sigma^{\mu\nu}\right)\right]u = 0$$

$$2m\,\bar{u}\gamma^\mu\gamma_5 u = \bar{u}\left[(p_2 - p_1)^\mu\gamma_5 + \frac{i}{2}(p_2 + p_1)_\nu\sigma^{\mu\nu}\gamma_5\right]u$$