at low energy and momentum and small quark mass we only need to include quark mass and momentum to lowest order

To order $p^2$ we can write down only one invariant term

$Tr \Sigma M + M^+ \Sigma$

possible mass terms to order $M$

$Tr \Sigma M + M^+ \Sigma$

same coefficients because Lagrangian should be real

Complete chiral Lagrangian

$L = \frac{E^2}{4} Tr \partial \Sigma \partial \Sigma^+ - \frac{1}{2} G Tr (\Sigma M^+ + \Sigma^+ M)$

$\Lambda = \begin{pmatrix} m_u & m_d & m_s \end{pmatrix}$

partition function

$Z = \int d \Sigma(x) e^{- S}$

spontaneous breaking $G \neq 0$

F is pion decay constant