- Vector-Dominance Model (ρ meson)

R. Rapp et al. PRL (1996), NPA (1997)

$$J_\mu^V = \frac{1}{2}(\bar{u}\gamma_\mu u - \bar{d}\gamma_\mu d) \equiv \frac{m_\rho^2}{g_\rho}\vec{\rho}_\mu$$

vacuum correlation function:

$$\begin{aligned}\Pi_{\mu\nu}^{\circ V}(q) &= -i\frac{m_\rho^4}{g_\rho^2}\int d^4x\, e^{iqx}\langle 0|\mathcal{T}(\vec{\rho}_\mu(x),\vec{\rho}_\nu(0))|0\rangle \\ &= -i\frac{m_\rho^4}{g_\rho^2}D_{\mu\nu}^{\circ\rho}(q)\end{aligned}$$

$$D_{\mu\nu}^{\circ\rho}(q) = -(g_{\mu\nu} + \frac{q_\mu q_\nu}{q^2})D_\rho^\circ(q^2) + \frac{q_\mu q_\nu}{q^2 m_\rho^2}$$

$$D_\rho^\circ(q^2) = (q^2 - m_\rho^2 - \Sigma_\rho(q^2))^{-1}$$

effective Lagrangian:

$$\mathcal{L}_{\rm VDM} = \mathcal{L}_\pi + \mathcal{L}_\rho + g_\rho(\vec{\pi}\times\partial^\mu\vec{\pi})\cdot\vec{\rho}_\mu + g_\rho^2(\vec{\rho}^\mu)^2(\vec{\pi})^2$$