Resonance Duality — Veneziano model.

The derivation of the FESR was as follows.

$$\int^{\Lambda^2} d\nu \left(A(s,t) - A^R(s,t) \right) \sim \int^{\Lambda^2} d\nu \, \frac{1}{\nu^{1+\epsilon}}$$

Duality: $D \sim \sum_n \frac{f(s,t)}{s - m_n^2}$ $\quad \sum_i \frac{g(t)}{\sin \pi\alpha(t)} \sim \sum_n \frac{g(t)}{\alpha(t) - n}$

sum over s-channel poles "=" approx. equal ~~sum over~~ t-channel poles, at high energy Λ^2.

Seemed to work, on average, at lower Λ^2, so let us postulate a stronger duality that works at all energies

Sum of s-channel poles strictly equals sum of t-channel poles:

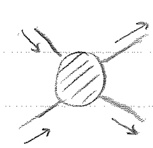
$$\underbrace{\sum_{n=0}^{\infty} \frac{r_n(s,t)}{s - m_n^2}}_{\text{s-channel res.}} = \underbrace{\sum_{n=0}^{\infty} \frac{r_n(t,s)}{t - m_n^2}}_{\text{t-channel res.}} \qquad \text{RESONANCE DUALITY}$$

How can this be possible? The residue function $r_n(s,t)$ in one channel must sum in such way so as to diverge to generate poles in the physical region of the other channel, and vice-versa.

→ Models satisfying the RESONANCE DUALITY are called Dual Resonance Models.

A very famous dual resonance model is the Veneziano model (1968)

$$\underset{\text{Veneziano amplitude}}{V(s,t,u)} = g\left[\underset{\text{Planar amplitude}}{B_4(s,t)} + B_4(s,u) + B_4(t,u)\right]$$



$$B_4(s,t) = \frac{\Gamma(-\alpha(s))\,\Gamma(-\alpha(t))}{\Gamma(-\alpha(s) - \alpha(t))}$$

for linear trajectories:

$$\alpha(t) = \alpha_0 + \alpha' t.$$