Update on one extended Regge trajectory

Of the various topics in the Twista Particle Performance, I'd like to single out the extended Regge trajectories, in fact just one of them. I remind readers that these are straight line fits to various particle resonance, extended by a freedom or symmetry ϵ inherent in the definition of spin:

$$j(j+1) = \vec{J}^2 = J(J+1)$$

$$\Rightarrow \quad j + \tfrac{1}{2} = \epsilon\,(J + \tfrac{1}{2}), \quad \epsilon = \pm 1.$$

It was shown in 1976[1] that e.g. for the $I=0$ natural parity mesons we could fit them well on a straight line if we plot ϵm^2 against j (Fig. 1, details in Ref. 1). The 1990 Data booklet lists more resonances and following the scheme of Ref. 1) we get an even more interesting picture, Fig. 2.

A rough statistical analysis gives the following very encouraging result. Regressing on the leading resonances ω, f_2, ω_3 and f_4 gives the equation

$$y = 0.58 + 0.83\,x, \quad \text{standard deviation} = 0.12.$$

Regressing on the leading resonances plus f_0, ω, f_2 gives the

extended trajectory:

$$J = 0.49 + 0.87\,x \quad , \quad \text{standard deviation} = 0.18.$$

However, if we put the last three resonances in a "daughter" trajectory with conventional J and m^2, we get

$$J = -1.57 + 0.90\,x \quad , \quad \text{standard deviation} = 0.35,$$

which shows it to be a worse fit. Also the slope is not universal.

More sophisticated analysis is being carried out.

Thanks to one of my co-authors in Ref. 1.

Reference: 1) Roger Penrose, George FJ Sparling and Tsou Sheung Tsun, J. Phys. A 11 (1978) L231.

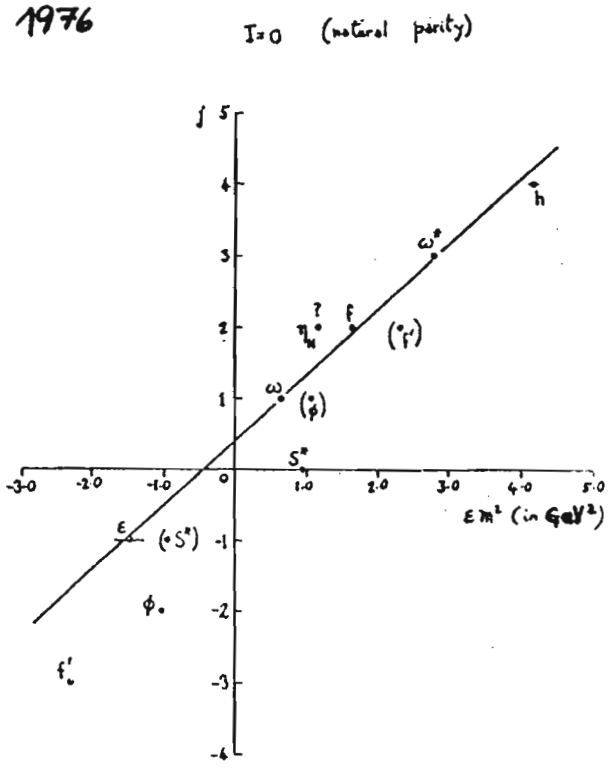

Fig. 1

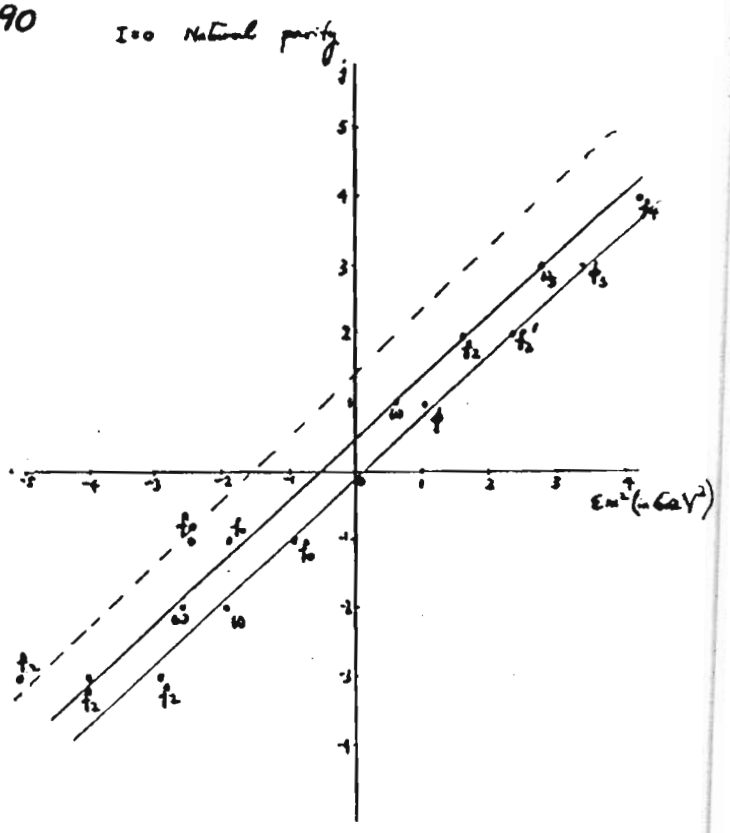

Fig. 2

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