

Pomeron spin-flip

- The non spin-flip part of the Pomeron is sensitive to the largest distances in the proton, while the spin-flip Pomeron component probes the smallest distances.

B.Zakharov & BK, PLB226 (1989) 156

- The smaller is a dipole the steeper is energy dependence of the dipole-proton cross section

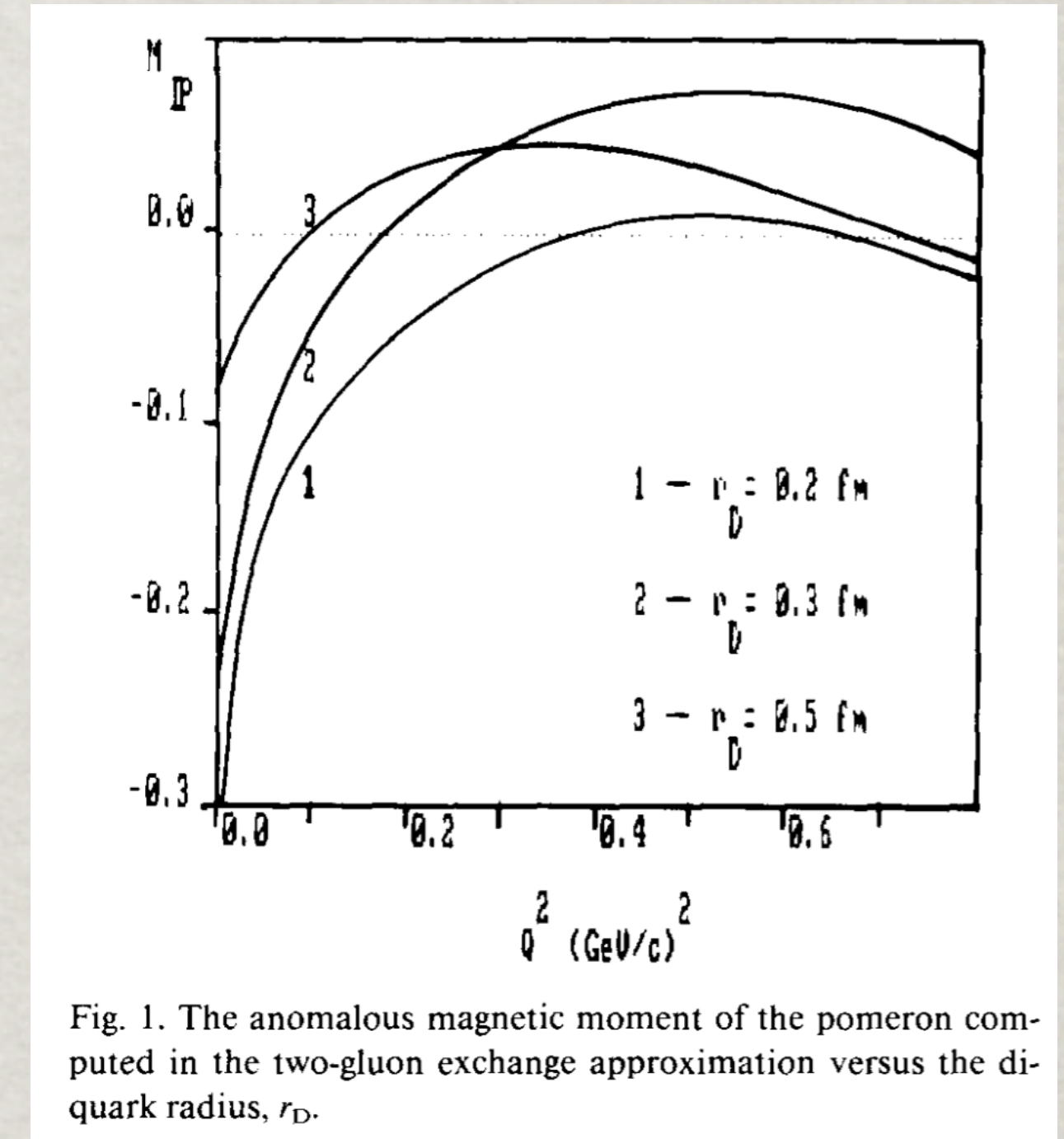
GBW parametrization $\sigma(\mathbf{r}) = \sigma_0 \left(1 - e^{-r^2/R_0^2}\right)$

$$R_0(\mathbf{x}) = 0.4 \text{ fm} \times (\mathbf{x}/\mathbf{x}_0)^{0.144}$$

Thus, at small r $\sigma(\mathbf{r}) \sim s^{0.3}$ while averaged $\langle \sigma(\mathbf{r}) \rangle \sim s^{0.1}$

The spin-flip component has a higher intercept compared to the non-flip one.

B.Povh & BK, Mod.PLA13(1998)3033



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The high intercept of the spin-flip Pomeron also results in pretty large real part of the amplitude

$$\frac{\text{Re } r_5}{\text{Im } r_5} = \frac{\pi}{2} [\alpha_{\text{P}}(0) - 1] \approx 0.5$$

Reggeon spin-flip

● According to duality (Veneziano model) if the scattering amplitude does not have s-channel resonances, then the t-channel exchanges, Reggeons, must **cancel** in the imaginary part. This is applicable to pp elastic scattering, since dibaryon resonances do not exist (most likely).

Therefore **ω** must cancel with **f** , as well as **ρ** cancels **a_2** . These pairs of Reggeons must be exchange degenerate, i.e. their Regge trajectories and residue functions must coincide.

This is well confirmed by the observed energy dependence of the total σ_0 cross section, which show very small Reggeon contribution to the imaginary part.

At the same time, the exchange degenerate Reggeons **add-up** in the real part, which is also well confirmed by data.

The same is true for the spin-flip amplitude, we expect a small contribution of **ω , f , ρ , a_2** to $\text{Im}r_5$, but large in $\text{Re}r_5$.

Besides, the residue functions are quite distinct

$$\frac{\omega + f}{\rho + a_2} \approx 0.1$$
$$\approx 10$$

in the spin-flip amplitude

in the non-flip amplitude

Pomeron vs Reggeons in r_5

mode	Energy	note	year	Re r_5	Im r_5
pp	21,321	STAR (stat err)	2012	-0.0342 ± 0.0024	-0.1500 ± 0.0272
pp	21,321	STAR (stat+sys err)	2012	-0.0337 ± 0.0047	-0.1413 ± 0.0582
pp	255	HJET blue (stat err)	2017	-0.0290 ± 0.0008	-0.0623 ± 0.0046
pp	255	HJET yellow (stat err)	2017	-0.0301 ± 0.0008	-0.0564 ± 0.0045
pp	100	HJET blue (stat err)	2015	-0.0459 ± 0.0014	-0.0219 ± 0.0050
pp	100	HJET yellow (stat err)	2015	-0.0485 ± 0.0013	-0.0162 ± 0.0049

Interplay of the exchange-degenerate Reggeons, falling with energy, and the Pomeron, rising with energy can explain the data.