

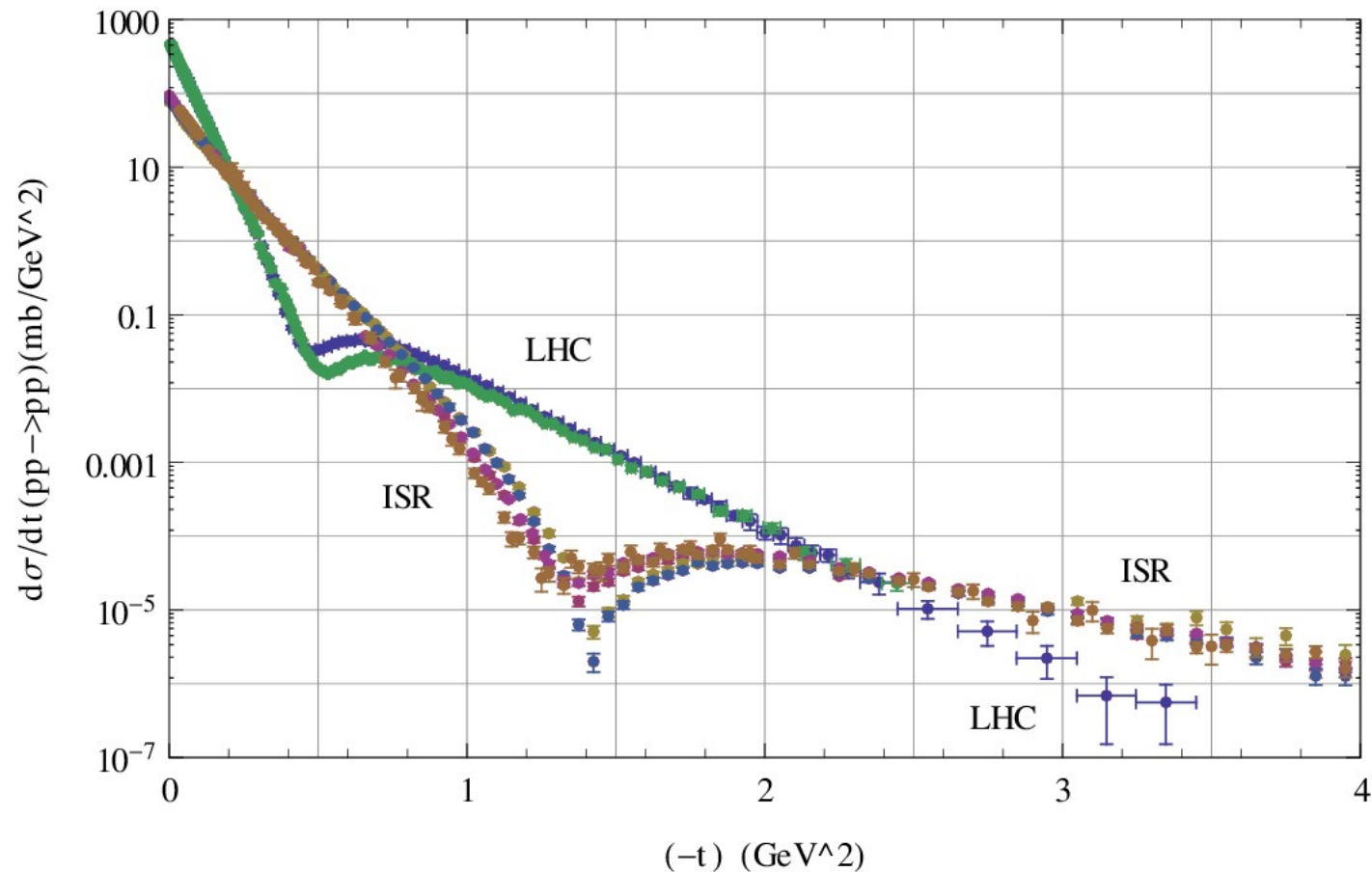
Commentary to:
The Stationary Points and Structure
of High-Energy Scattering Amplitude

A.P. Samokhin and V.A. Petrov

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IHEP, PROTVINO

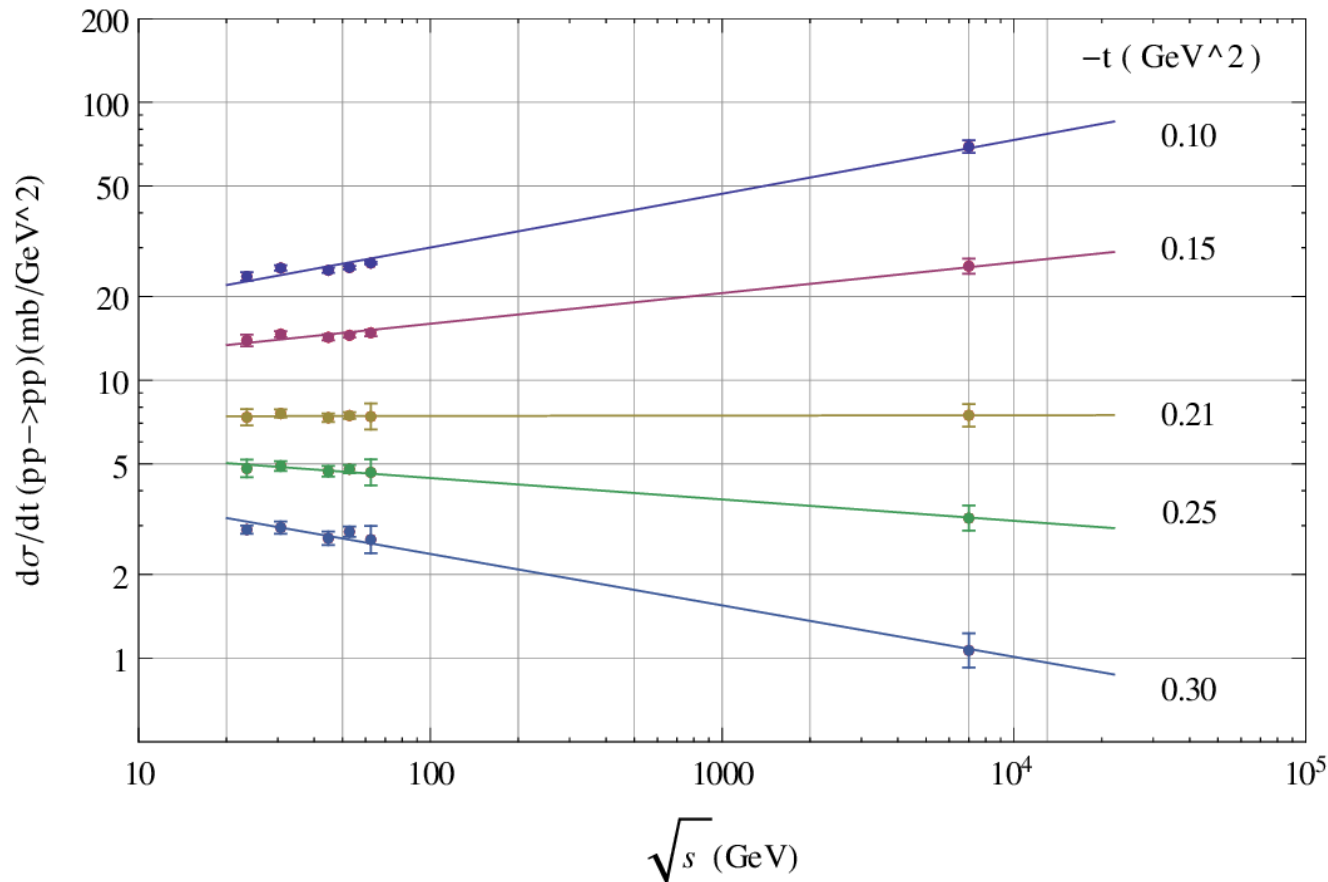
$d\sigma/dt$ at the ISR and the LHC (7 and 13 TeV) energies



An evidence of the second stationary point at

$$t^{**} \approx -2.3 \text{ GeV}^2, \quad \sigma^{**}(s) \equiv \frac{d\sigma(s, t^{**})}{dt} \approx 33 \text{ nb}/\text{GeV}^2$$

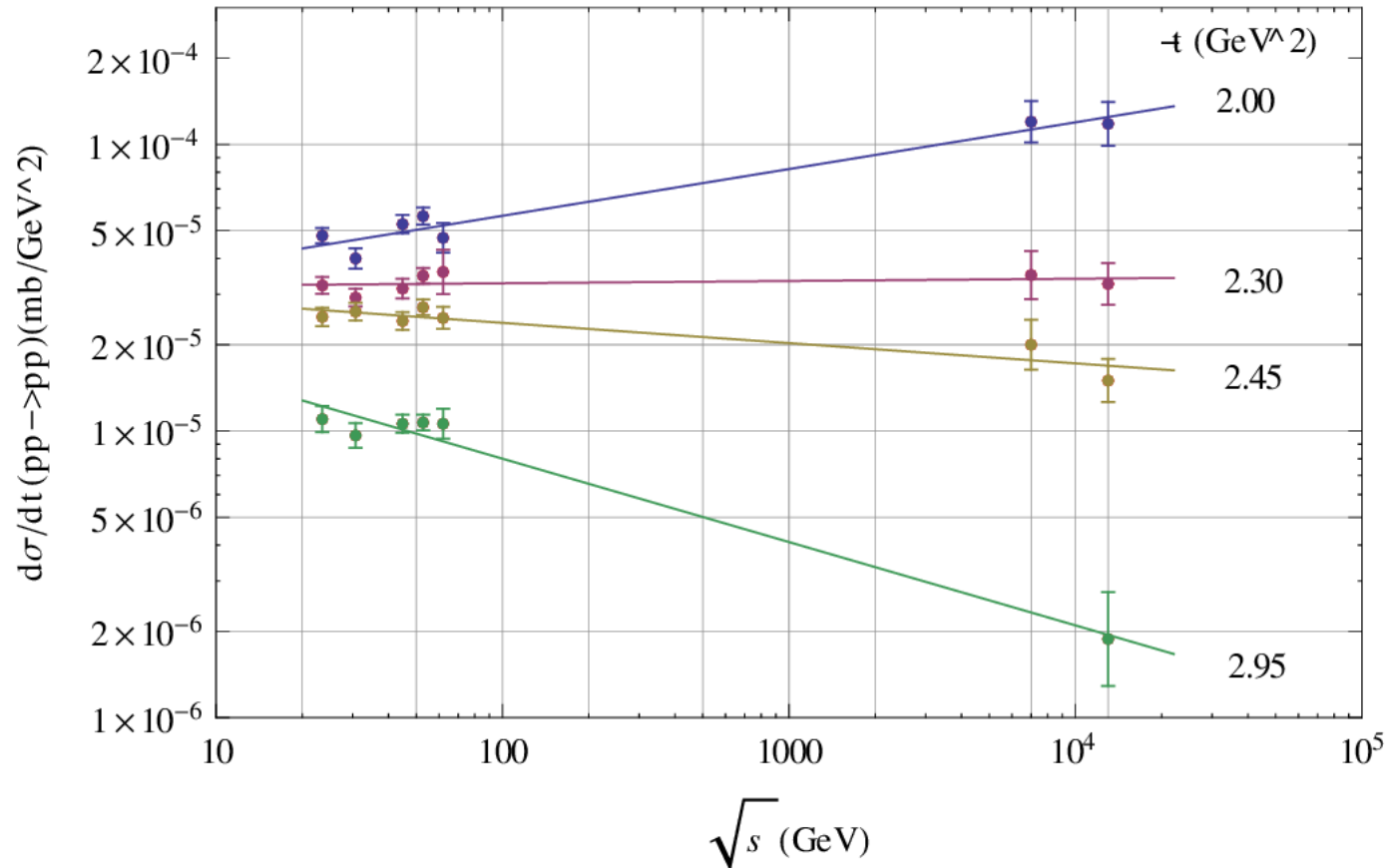
Energy evolution of $d\sigma/dt$ at fixed values of transferred momenta



Stationary point (t_*, σ_*) of $d\sigma/dt$

$$t_* \approx -0.21 \text{ GeV}^2, \quad \sigma_*(s) \equiv d\sigma(s, t_*)/dt \approx 7.5 \text{ mb} / \text{GeV}^2$$

$d\sigma/dt$ in the vicinity of $t = - 2.3 \text{ GeV}^2$



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On a Possible Stationary Point in High-Energy Scattering

V.A. Petrov and A.P. Samokhin
Institute for High Energy Physics,
“NRC Kurchatov Institute, Protvino”, RF

Abstract

We discuss a curious observation: at energies from the ISR and up to the LHC, inclusively, the differential cross-section of elastic proton-proton scattering remains almost energy-independent at the transferred momentum $t \approx -0.21\text{GeV}^2$ at the level of $\approx 7,5 \text{ mb/GeV}^2$. The latter value can be considered as a prediction for $d\sigma/dt$ at 13 TeV. We also obtain a lower bound for the forward pp slope at 13 GeV.

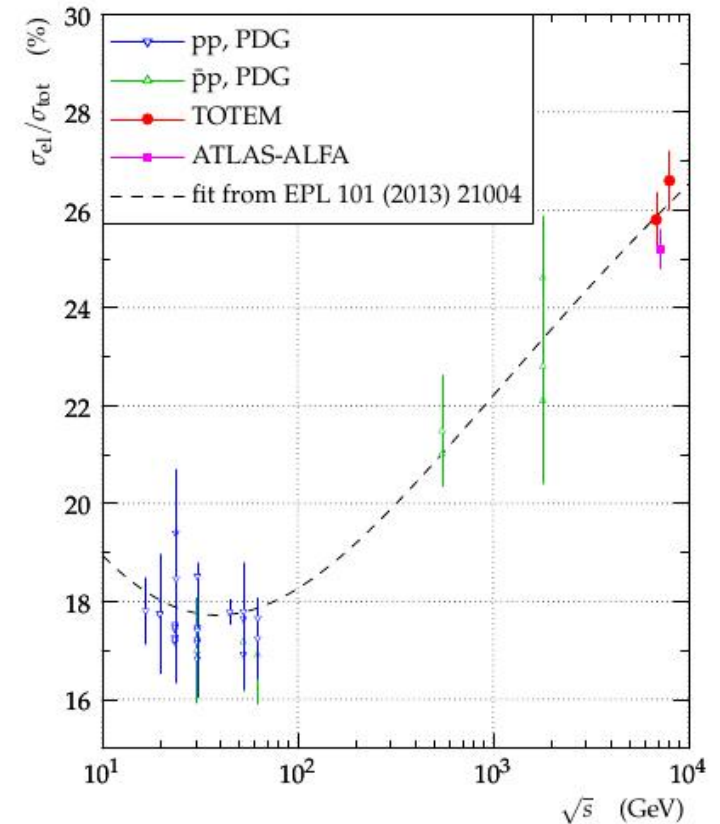
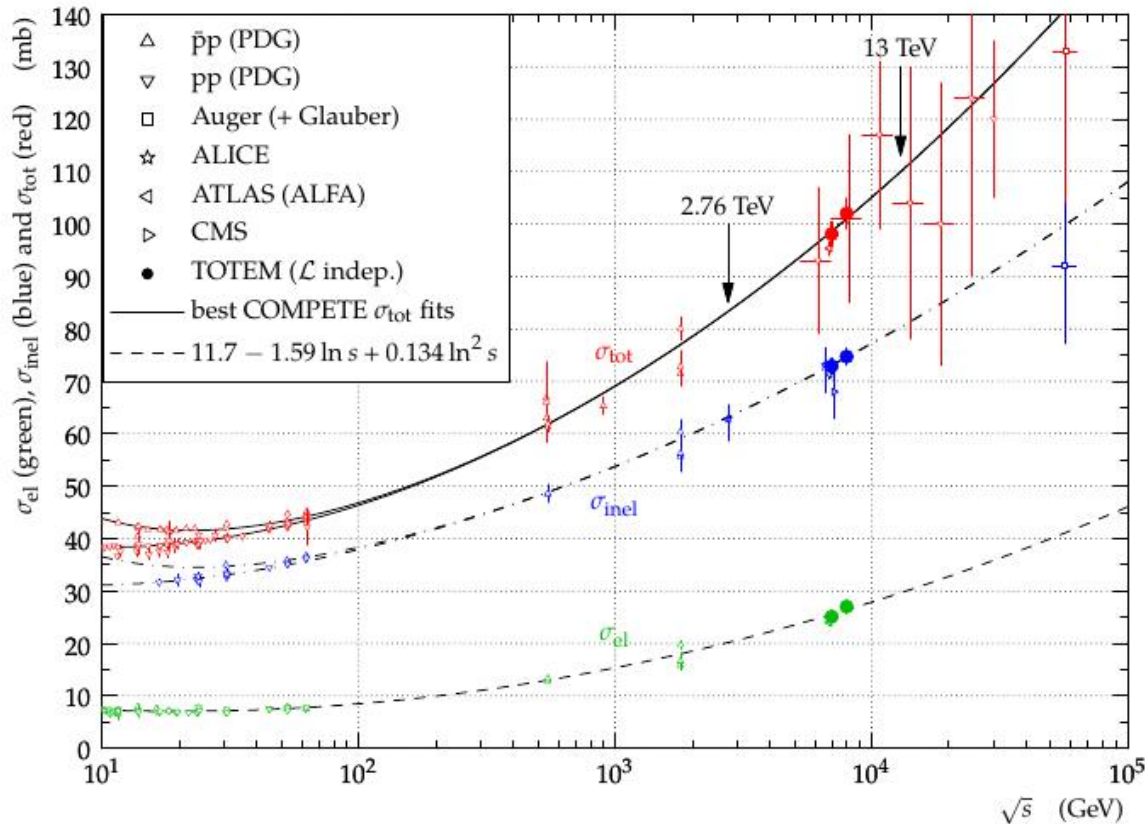
1 Hints at the Stationary Point

It is well and long ago known that at $-t < 0.15 \text{ GeV}^2$ the pp differential cross-section grows with energy. On the contrary, at $-t > 0.3 \text{ GeV}^2$ they clearly decrease[1]. Recent LHC data confirm these both trends.

This circumstance may impose a speculation that there could exist between these two regions of t a point t_* where differential cross-section doesn't change with energy at all. The stationary points of the differential cross-sections were discussed *en passant* many years ago in Refs. [2],[3] but didn't find any conceptual development. We, thus, assume that there exists a fixed (energy independent) point t_* where

$$d[(d\sigma/dt)(s, t_*)]/ds \approx 0$$

Approximate Geometrical Scaling in the ISR energy region

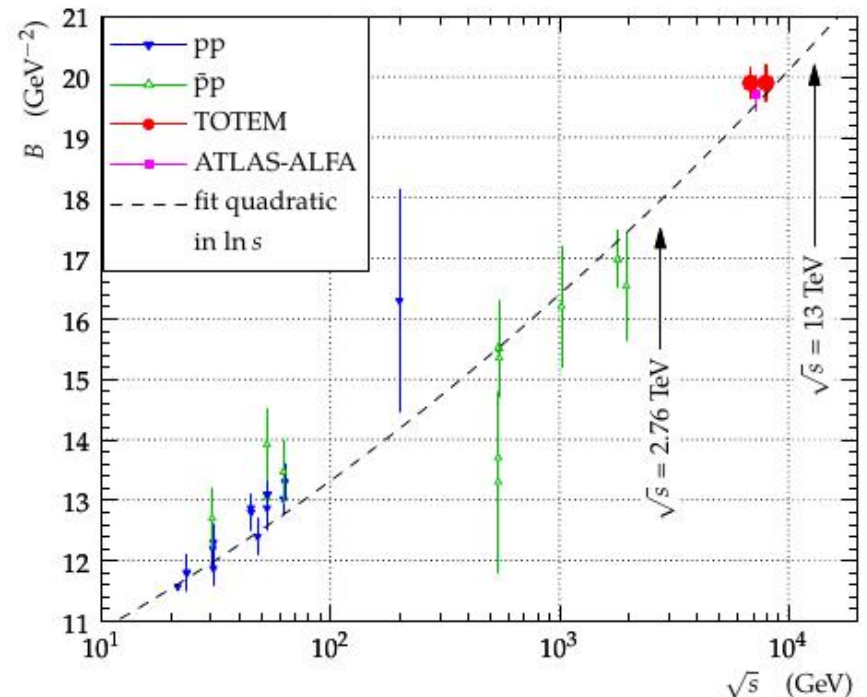
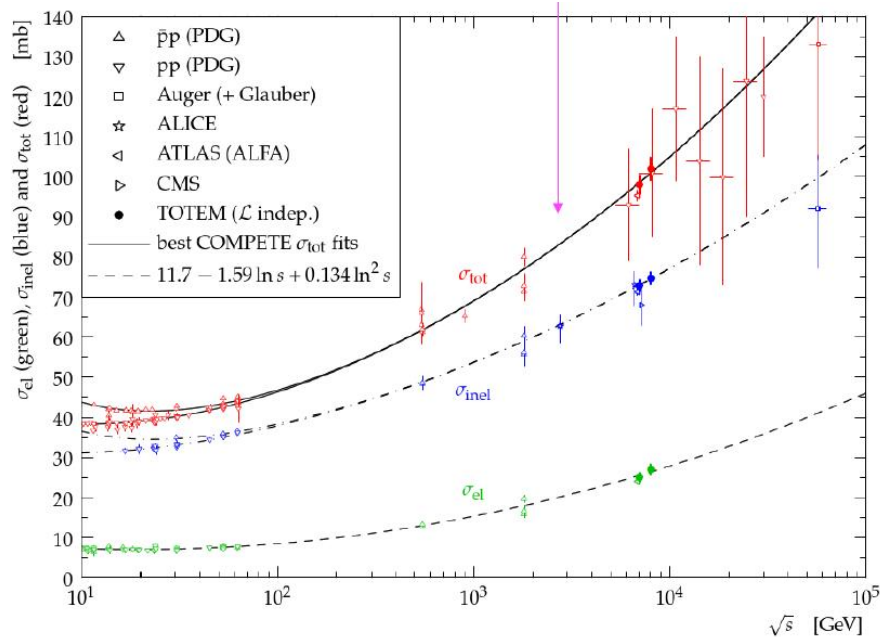


$$T(s,b) = T(b/R(s))$$

$$d\sigma/dt = R^4 F(R^2t)$$

$$\sigma_{el}(s) \sim \sigma_{tot}(s) \sim B(s) \sim R^2(s)$$

At $t=t_*$ the growth of $\sigma_0(s)$ and growth of the local slope in $d\sigma/dt$ compensate each other, but due to the unitarity this stationarity has a transitory character and must be followed by decreasing of $d\sigma/dt$



Геометрический скейлинг:

$T(b/R(s)) \rightarrow d\sigma/dt = (R^4)F(R^2t) \rightarrow$
 $d(d\sigma/dt)/ds \sim (2+Bt), \quad B \text{ — наклон.}$
Откуда следует, что $d(d\sigma/dt)/ds = 0$
при $t_{GS} = -2/B(s)$. Эта точка с
ростом $B(s)$ быстро смещается к
нулю. А наблюдаемая от ISR до
LHC стационарность $d\sigma/dt$ имеет
место при фиксированном $t_* =$
 -0.21 GeV^2 и является следствием
нарушения GS, т. е. роста σ_{tot}/B .

Итак, стационарной точки $t_{GS} = -2/B(s)$, о которой идет речь в работах Баргера и др.(1975) и Арушанова и др.(1983), в природе не существует. Обсуждаемые же нами две стац. точки являются новым, никем не предсказанным, открытым на ЛНС, экспериментальным фактом.
СПАСИБО!