Mario Greco @ Frascati

Yogendra Srivastava
University of Perugia, Perugia, Italy
+
Giulia Pancheri
INFN, LNF Frascati

Mario with an unknown Indian in Frascati, 1972

Some Early Mutual Work On Resummation in QED & QCD

- Radiative Corrections for Colliding Beam Resonances. M. Greco, G. Pancheri-Srivastava, Y. Srivastava, (Frascati) . LNF-75/23-P. 42pp. Nucl.Phys.B101:234,1975

- QCD AND DUALITY IN e+ e- ANNIHILATION. M. Greco, (Frascati) , G. Penso, (Rome U. & INFN, Rome) , Y. Srivastava, (Frascati) . LNF-78/49-P, 11pp. Phys.Rev.D21:2520,1980.

Standard Soft Photon Radiative Corrections

Bloch-Nordsick Method developed by E. Etim, G.Pancheri & B. Touschek:

In the cross-section

In the amplitude by M. Greco and G. Rossi through Coherent States

Both had to be modified for narrow resonances:

Radiatively Corrected J/Psi e+e- Cross-section

$$\tilde{\sigma}(M) = \frac{6\pi^2 \Gamma_e \Gamma_h}{\sqrt{2\pi}\sigma M^2 \Gamma} \left(\frac{\Gamma}{M}\right)^{\beta_i} \left(1+\frac{\Gamma^2}{8\sigma^2}\right) \left\{1 - \frac{\Gamma}{\sqrt{2\pi}\sigma} + \beta_i \times \right.$$

(5.5)

$$\left. \times \left[\ln \frac{2\sqrt{2}\,\sigma}{\Gamma} - \gamma/2\right]\right\} \left(1+C_F^{RES}\right),$$

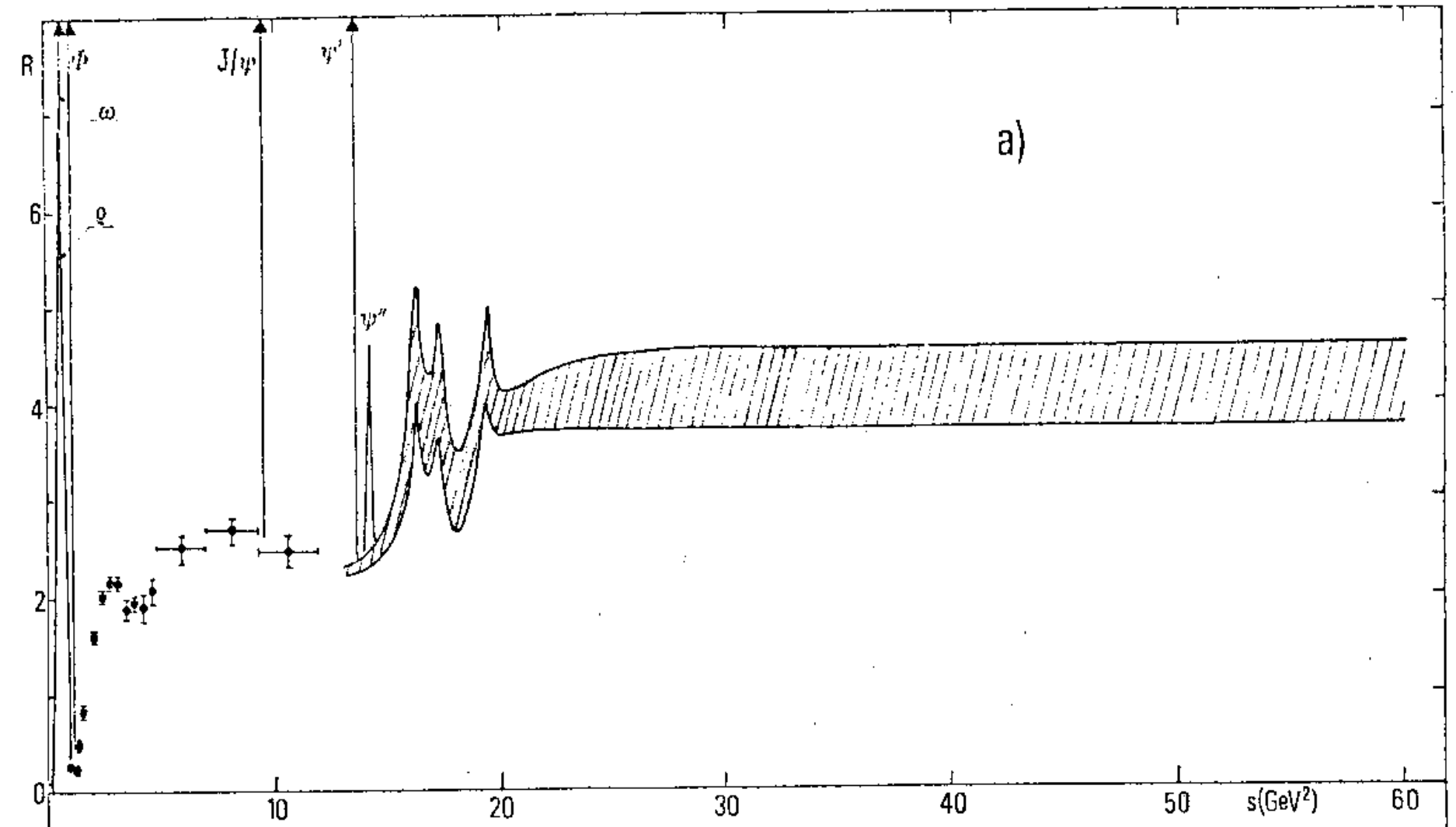
$\alpha_{strong}(s)$ at small s ?

Difficult question but not beyond all conjecture

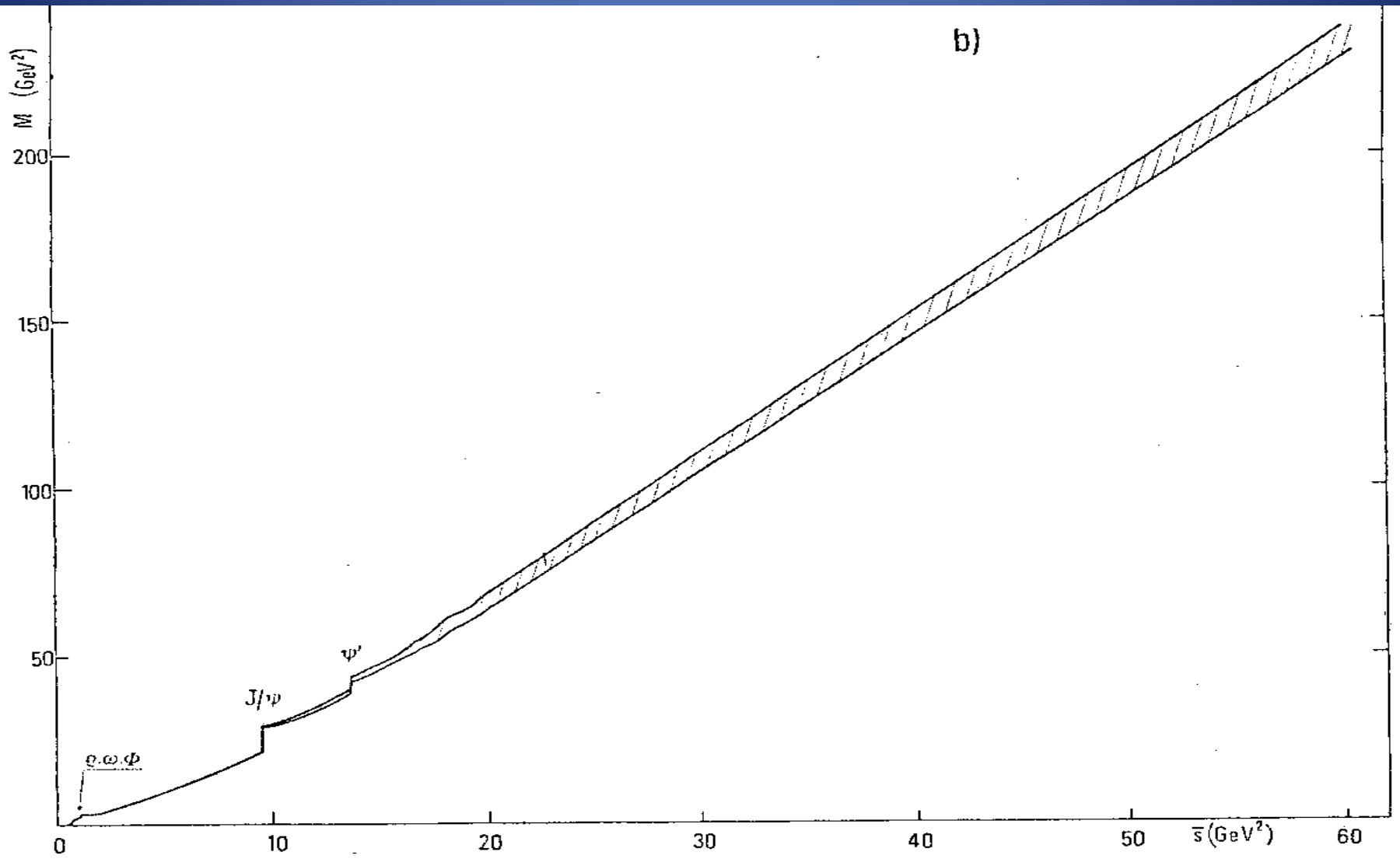
- What is now called “frozen alpha” was first employed in our Phys. Rev. paper
- Continuation of asymptotic freedom alpha into low energy domain for confrontation with low energy data from Frascati and SLAC

$$R(s) = \sum_i Q_i^2 [1 + \frac{\alpha_s(s)}{\pi}]$$

R(e+e->hadrons)



$$M(\bar{s}) = \int_{4m_\pi^2}^{\bar{s}} (ds) R_{experiment}(s)$$



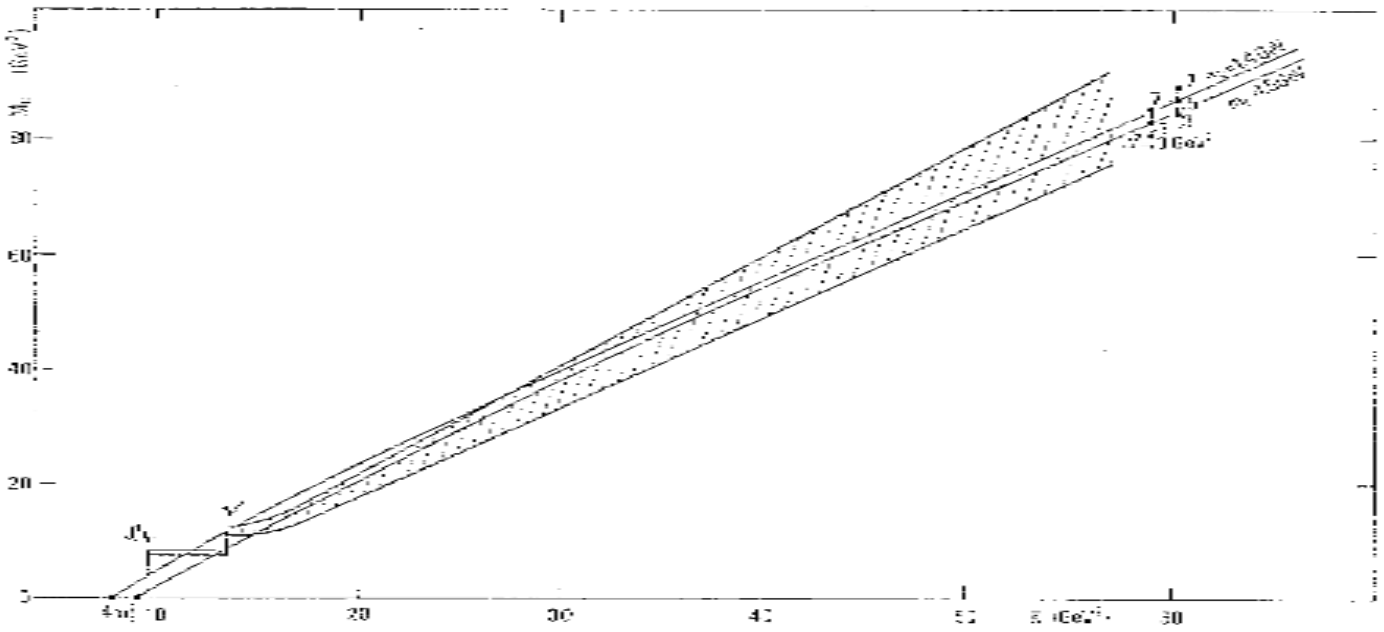


Fig. 3 – $M_{\gamma\gamma}(s)$ vs. $\sqrt{s}$. The band in the figure takes into account both the experimental error associated with $R_{exp}(s)$ as well as the error in the subtraction. The theoretical curves are for m_c = 1.4 (1.5) GeV and A^2 = 3.5 GeV^2. For each mass value, a representative point for A^2 = 3.3 and 0.7 GeV^2 is also shown.

Coherent State Approach To The Infrared Behavior Of Nonabelian Gauge Theories.

M. Greco, F. Palumbo, G. Pancheri-Srivastava, Y. Srivastava

Phys.Lett.B77:282,1978.

QCD Jets From Coherent States.

G. Curci, M. Greco, Y. Srivastava, 27pp.

Nucl.Phys.B159:451,1979.

Coherent Quark - Gluon Jets.

G. Curci, M. Greco, Y. Srivastava

Phys.Rev.Lett.43:834-837,1979.

Inclusive Parton + Transverse Momentum Distributions

Using the above results the super-inclusive cross-sections for n_q and n_g quark and gluon jets, respectively, are thus given by

$$d\sigma_{super}^{(n_q, n_g)} = d\sigma_0 \exp\left\{-\frac{1}{\pi}\left[n_q I_q(\epsilon) + n_g I_g(\epsilon)\right]\int_{k_{1T}}^{k_{2T}} \frac{dk_T}{k_T}\,\bar{\alpha}(k_T)\right\}, \qquad (8)$$

$$\frac{d^2P}{d^2K_T} = \frac{1}{4\pi^2}\int_{-\infty}^{\infty} d^2\vec{x}\; e^{-i\vec{x}\cdot\vec{K}_T} \exp\left\{-\frac{1}{\pi^2} I(\epsilon)\int_0^{Q^2/4} \frac{d^2k_T}{k_T^2}\,\bar{\alpha}(k_T)\left[1 - e^{i\vec{x}\cdot\vec{k}_T}\right]\right\} \qquad (15a)$$

"High Energy" Transverse Momentum Distribution

The pt distribution in 1979

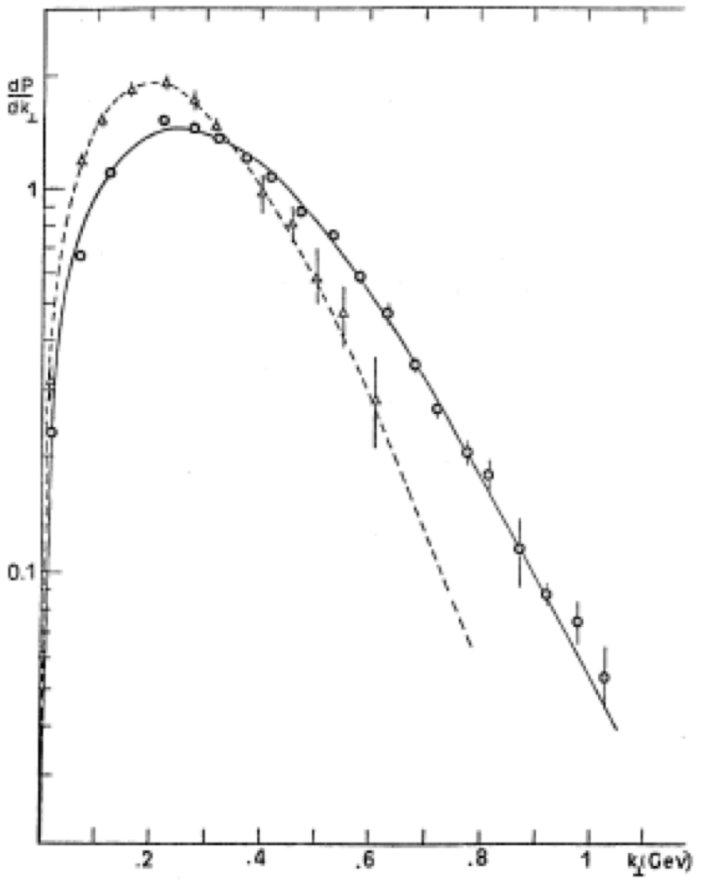


FIG. 1. Normalized $\sigma^{-1} d\sigma/dk_\perp$ vs $k_\perp$ for $Q = 3$ GeV (triangles) and 7.5 GeV (circles) SPEAR single inclusive data from Ref. 6. Our results are given by the dashed line for 3 GeV and by the solid line for 7.5 GeV.

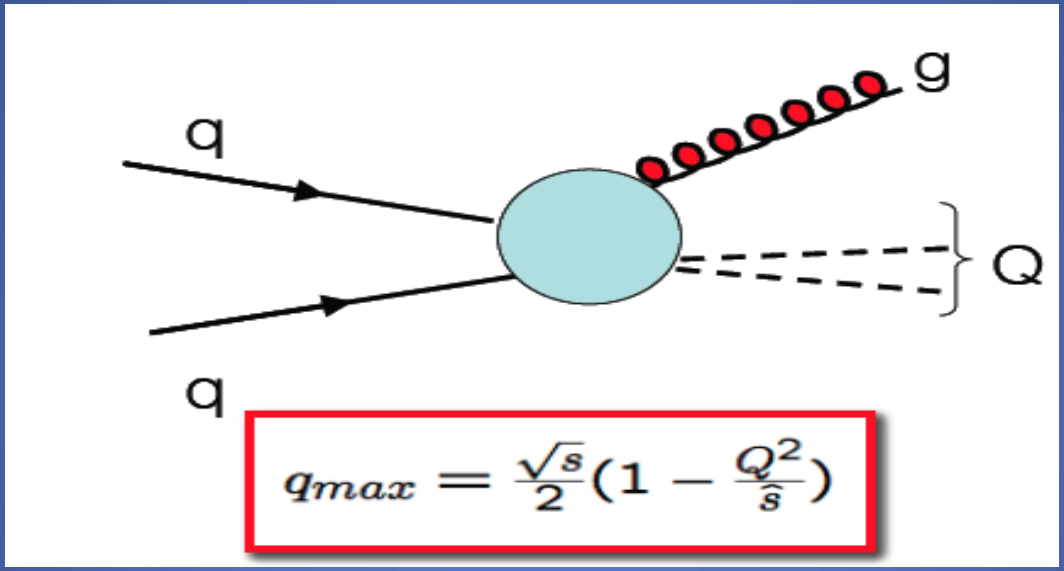
P(T) Effects For Drell-Yan Pairs In QCD.

P. Chiappetta, M. Greco, (Frascati)

Nucl.Phys.B199:77,1982.

In this work on Drell-Yan, a very useful concept that of the maximum transverse momentum in a given partonic process was developed. This parameter Qmax has been used by us [Grau, Pancheri, Godbole, Achilli etc.] extensively in our later papers on soft-gluon resummation in total and inelastic hadronic cross-sections

Qmax Averaged over Parton Densities



$$q_{max}(s) = \frac{\sqrt{s}}{2} \frac{\sum_{i,j} \int \frac{dx_1}{x_1} f_{i|A}(x_1) \int \frac{dx_2}{x_2} f_{j|B}(x_2) \sqrt{x_1 x_2} \int_{z_{min}}^{1} dz(1-z)}{\sum_{i,j} \int \frac{dx_1}{x_1} f_{i|A}(x_1) \int \frac{dx_2}{x_2} f_{j|B}(x_2) \int_{z_{min}}^{1} (dz)}$$

LHC Inelastic Cross-section

An example of the use of Qmax is shown in a soft-gluon resummed model by Achilli et al

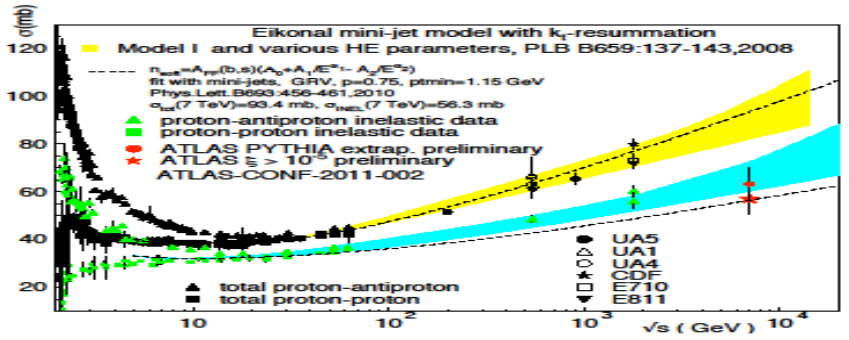


Figure 5. Total and inelastic data for pp and $\bar{p}p$ scattering compared with the prediction from our model (dashed curve), when the same eikonal function is used both for the total and the inelastic cross-sections, from low to high energy. The upper band is the same as in Fig.2, the lower refers to the inelastic cross-section and is the same as the one in Fig. 77. Comparison is made with preliminary ATLAS data extrapolated using Pythia $d\sigma/d\xi$ (round full symbol) and with ATLAS data in the range $\xi > 10{-}5$, where $\xi = M_X^2/s$ (star symbol) [44].

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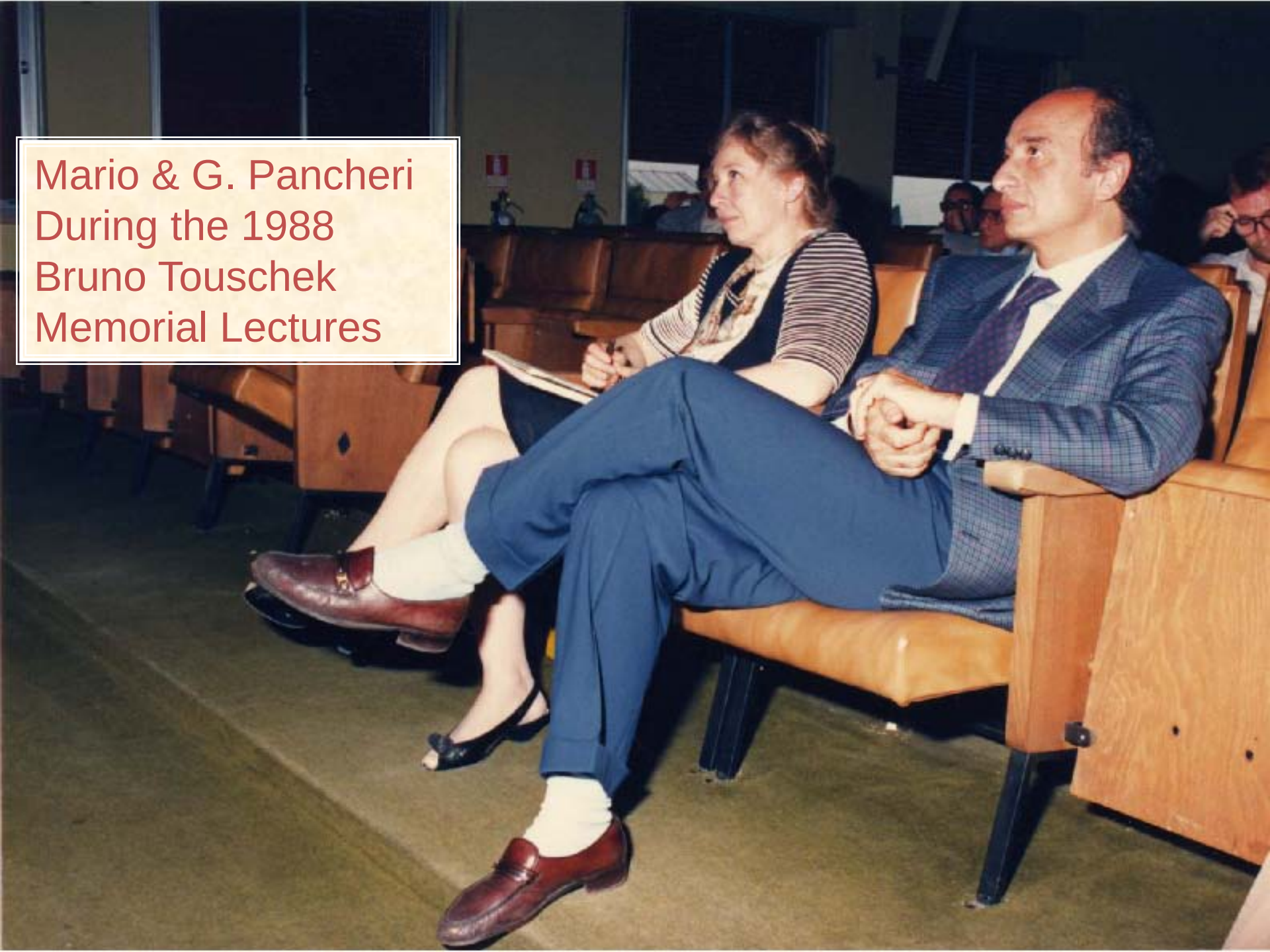
Mario & G. Pancheri
During the 1988
Bruno Touschek
Memorial Lectures