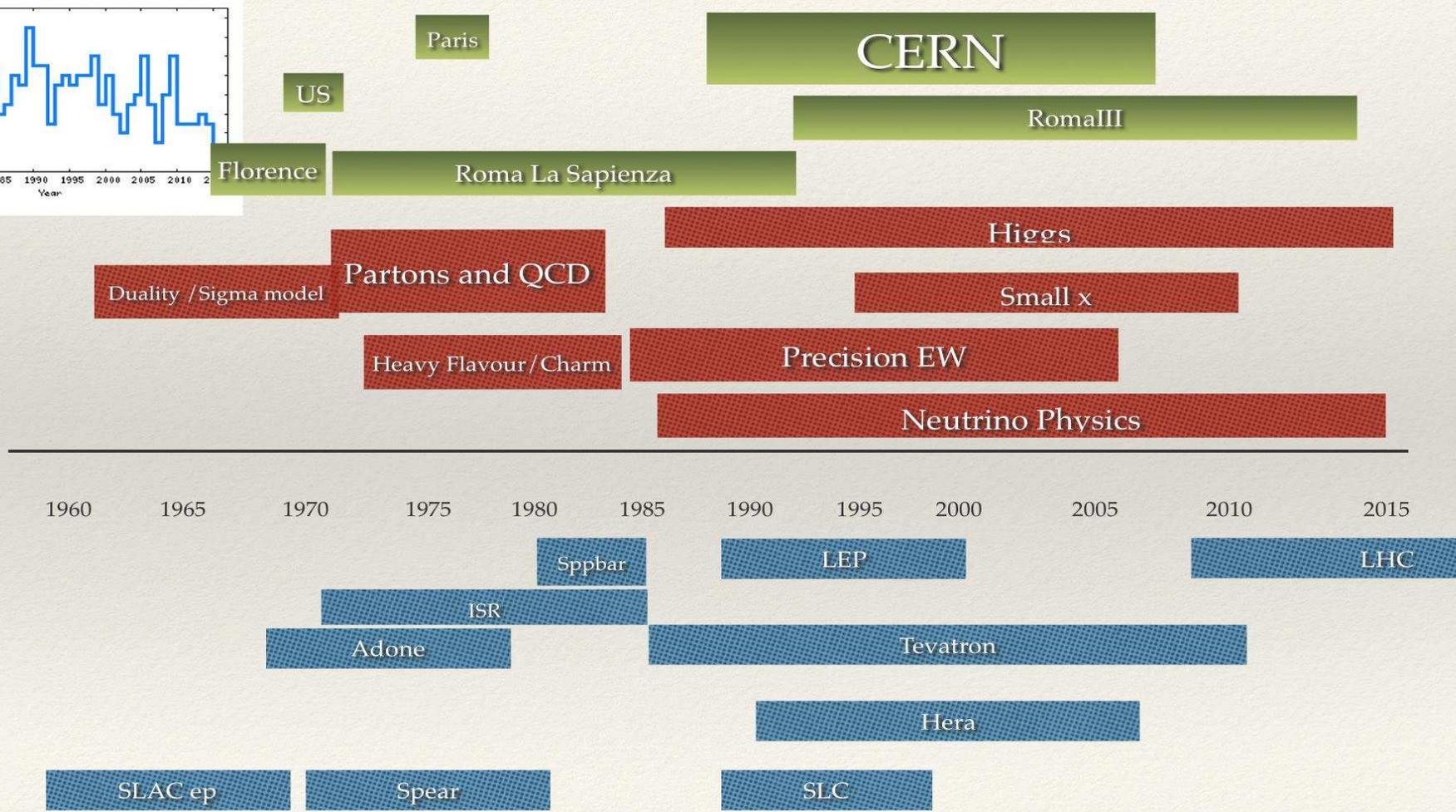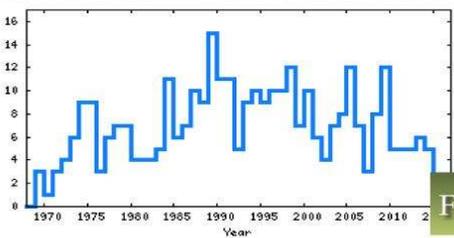# Remembering Guido Altarelli
(Fifty years of friendship)

Vulcano, May 25, 2016

Mario Greco, Roma Tre

Life in the vanguard of science

First years

- ## University friends and future colleagues

  F. Buccella, G. Capon, S. Doplicher, G. Gallavotti, A. Giazotto, M. Greco, L. Maiani, F. Melchiorri, P. Picozza, P. Spillantini, …

- ## Diploma thesis

  1st attempt with B. Touschek

  2nd attempt with R. Gatto together with F. Buccella:

  "Single photon emission in high energy e+e- collisions"

  Nuovo Cimento 34 (1964) 1337.

- ## Florence with R. Gatto

  I gattini (the kittens)

New York, Rome: years pre-QCD

- S-Matrix duality, Light cone expansion

    H. Rubinstein, R. Brandt, G. Preparata

- Sigma term, DIS, Octet-enhanc. of non lept. weak interactions.

    N. Cabibbo, L. Maiani

- Weak decays of charmed particles

    N. Cabibbo, L. Maiani

→ Complicate formalism

    Operator product expansion, Renorm. group eqs., …

Paris: the AP equations

G. Parisi   at   Moriond   1976

'-//- 77
江研図書室

'resented at 'The Intern.
Meeting on Neutrino Physics',
'laine, March 6-12, 1976.

COMITATO   NAZIONALE   PER   L'ENERGIA   NUCl
Laboratori Nazionali di Frascati

LNF-76/25(P)
12 Aprile 1976

G. Parisi: AN INTRODUCTION TO SCALING VIOLATIONS.
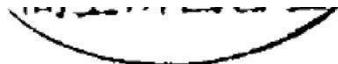
Paris: the AP equations

G. Parisi at Moriond 1976

$$\frac{dN_e(x, L)}{dL} = \frac{\alpha}{2\pi} \int_x^1 \frac{dy}{y} N_e(y, L) p_{ee}(x/y) =$$

$$\frac{dN_\gamma(x, L)}{dL} = \frac{\alpha}{2\pi} \int_x^1 \frac{dy}{y} N_e(y, L) p_{\gamma e}(x/y).$$

Simple evolution eqs. For electron and photon distributions after bremsstrahlung, suggesting a similar treatment in QCD.

Paris: the AP equations

G. Altarelli [*]

Laboratoire de Physique Théorique de l'Ecole Normale Supérieure [++]

Paris, France

and

G. Parisi [#]

Institut des Hautes Etudes Scientifiques

Bures-sur-Yvette

ABSTRACT : A novel derivation of the Q^2 dependence of quark and gluon densities (of given helicity) as predicted by Quantum Chromodynamics is presented. The main body of predictions of the theory for deep inelastic scattering on either unpolarized or polarized targets is reobtained by a method which makes only use of simplest tree diagrams and is entirely phrased in parton language with no reference to the conventional operator formalism.

* "In our paper a particular emphasis was devoted to prove that splitting functions are a property of the theory and do not depend on the process."

* Time ordered perturbation theory.
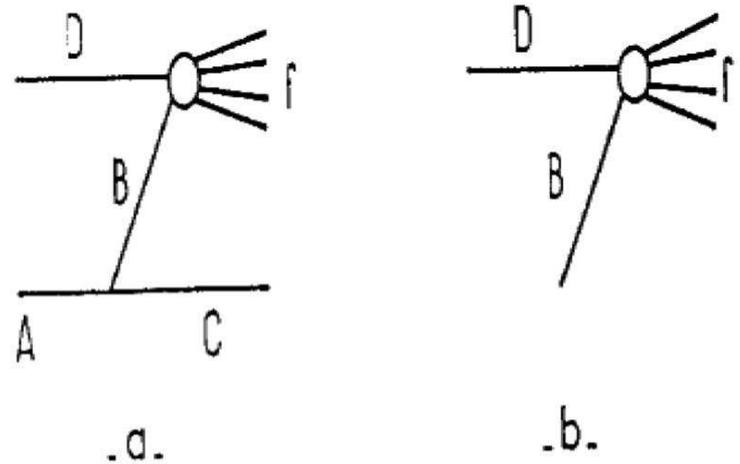
* Physical gauge

FIG. 1

The two processes are related by :

$$d\sigma_a = d P_{BA}(z)\, dz\, d\sigma_b$$

we obtain :

$$dP_{BA}(z)\, dz = \frac{E_B}{E_A}\, \frac{g^2 |V_{A \to B+C}|^2}{(2E_B)^2 (E_B + E_C - E_A)^2}\, \frac{d^3 k_\tau}{(2\pi)^3 2E_C}$$

Corrections to Drell-Yan (K factor)

AP eqs. give a procedure for improving the QCD prediction in perturbation theory.

G. Altarelli, K. Ellis, G. Martinelli, Nucl. Phys.. B157(1979)461
Found large corrections to 1-loop:
Problems in pert. theory?

 G. Parisi, Phys.Lett. B84 (1979) 225
 G. Curci , M.Greco, Phys.Lett. B92 (1980) 175

Soft behaviour of the theory and kinematical constraints play an important role and most of the corrections get exponentiated.

Diagrams for NLO prediction

(a)

(b)   (c)
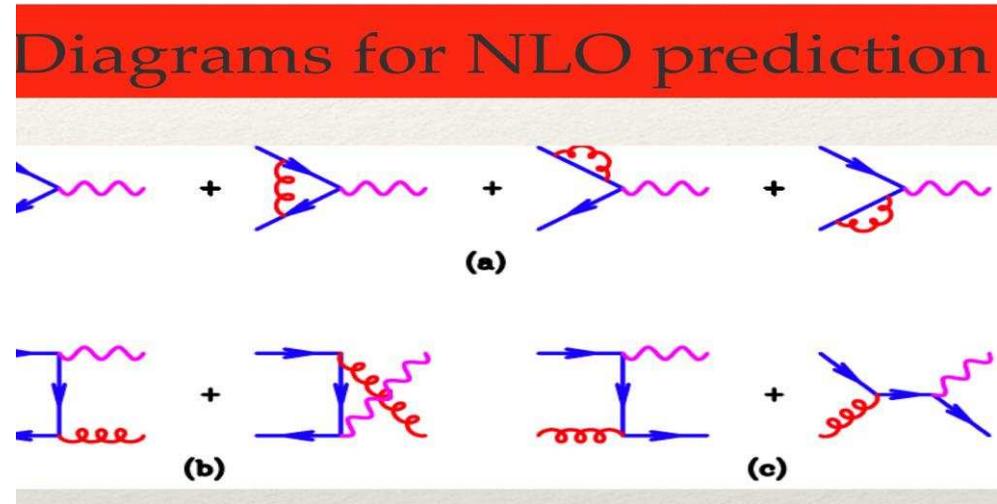
Accademia dei Lincei – Roma 1979

Chania, Crete – 1980   (Thanks to G. Martinelli)

Mario Greco - Vulcano Workshop

Pt - distrib. of Drell-Yan pairs, Z, W, H,…

- NLO (1-loop) results of G.Altarelli,K.Ellis,G.Martinelli not enough to explain data (UA1, …)

- Resummation of soft effects to all orders and resulting formula in impact-parameter space: G.Curci, M.Greco, Y.Srivastava, NP B159(1979)451

- Merging of two approaches led to the important result by Altarelli, Ellis, Greco, Martinelli , NP B246 (1984) 12. Basic th paper for all Pt-distr. (W,Z,H,…)

- Further activity in QCD (small-x physics,..) later.

International Conference on
Flavor Physics and Mass Generation 10 to 14 February 2014
Nanyang Technological University, Singapore
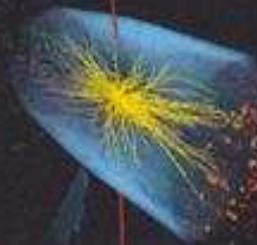
The Early Days of QCD (as seen from Rome)

G. Altarelli(1)

(1) Dipartimento di Fisica 'E. Amaldi', Università di Roma Tre and INFN, Sezione di Roma Tre, I-00146 Rome, Italy and
CERN, Department of Physics, Theory Unit, CH–1211 Geneva 23, Switzerland

Summary. — In honour of Mario Greco I present my recollections on the QCD studies in Rome in the '70's and early 80's and on our very friendly group of people involved.

PACS 11. 15, 12. 38 − . . . .

I have a half-century-long friendship with Mario. We met when students at the University of Rome in the early 60s. Then in '64 I went to Florence and then in '68 to the USA. When back in Rome in '70 we came in closer contact, also with our families. In fig. 1 one can get an idea of how different we looked at the time. At present we are both at Roma Tre and our offices are a few meters away. In the early '70's QCD and the physics of hard processes was an area of common interest for many of us in Rome and a number of good results were obtained by the different members of our group. Here I will review these results and try to convey the collaborative atmosphere in the group that,

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