I was luckily to be educated in Rome in a wonderful atmosphere with an exceptional mentor: Nicola Cabibbo (1935-2010).

There were also many other great people at Rome. Let me remember here Bruno Touschek (1921-1978), who was Nicola's mentor.

He discovered that it was possible to construct particle antiparticle colliding beams using only one ring. With his collaborators he constructed the first $e^+ e^-$ collider (AdA) in Frascati (1960) (400 MeV in the center of mass).

I graduated in 1970. The times were exciting because of the new $e^+ e^-$ machine, Adone, 3 GeV in the center of mass. Adone started its operations in 1969. The experiment were observing a rather strong (roughly speaking energy independent) multi-hadron production, that was unexpected from theory.

A key episode happened around 1970. A preprint arrived. Someone had computed the cross section for the process

$e^+ e^- \longrightarrow e^+ e^- + hadrons \qquad e^+ e^- \longrightarrow e^+ e^- + \gamma\gamma(virtual) \qquad \gamma\gamma \longrightarrow hadrons$

The cross section computed in the paper was proportional to

$$\alpha^4/m_e^2 \, .$$

The correct result was

$$\alpha^4/E^2 \, .$$

The wrong results was a factor E^2/m_e^2 too large!

Nicola started to be interested in finding a fast way for doing such computations with a reasonable accuracy.

He started to use a generalization of Weitzecker Williams method. He computed the probability of finding a gamma inside an electron with longitudinal momentum proportional to z (in the P_∞ frame).

For example in his paper (Cabibbo-Rocca, Cern preprint 1974), we find the following formulae for the fragmentation probabilities (integrated over the transverse momenta)

$$\frac{dP_{\gamma\to e^+e^-}(z)}{dz} = \frac{\alpha}{\pi}\left(1+(1-2z)^2\right)\log(E/m_e)\,,$$

$$\frac{dP_{e\to e\gamma}(z)}{dz} = \frac{\alpha}{\pi}\,\frac{1+(1-z)^2}{z}\log(E/m_e)\,.$$

Our task (with Guido) was easy. We had to change notation ($e \to q$, $\gamma \to g$), to compute the function

$$\frac{dP_{g\to g\,g}(z)}{dz}\,,$$

to add polarization and group factors. At the end the final equations were checked against the known results from field theory.

Why some people were interested in this paper?

- The derivation was much more simpler and intuitive than the field theory one (the needed paraphernalia where the Wilson expansion, the light cone expansion, asymptotic behaviour at exceptional momenta, the Mellin transform).
- The paper stressed the idea that main difference with the naive parton model was the presence of energy-dependent effective parton densities.
- The paper strongly suggested that it was possible to introduce effective parton densities depending from both the rapidity and the transverse momenta: these densities can be used to compute events with large transverse momenta in the process

$$p\,p \rightarrow hadrons + \mu^{+}\mu^{-}$$

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