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My field of activity is subnuclear physics and is directed towards what is termed 'the Standard Model'. This is the greatest synthesis of all times in understanding the basic Logic of Nature. Some major issues in subnuclear physics have attracted my interest. The following five points have been my contribution – during these four decades – to the building up of the Standard Model.

1. *The Third Lepton*

The problem of divergences in electro-weak interactions and the third lepton. Physics results are finite: why then do theoretical calculations, for example in Quantum Electro-Dynamics (QED), give rise to divergent quantities? High precision measurements in QED and in weak interactions attracted my interest. In fact, for example, the contributions of virtual weak processes in the elementary properties of the muon should produce divergent results. The cure for divergences was called, by theorists, renormalization. My career started with the first high precision measurements of the muon electromagnetic and weak basic properties, i.e. its anomalous magnetic moment (measured with ± 5 x 10-3 accuracy), and its weak charge (measured with ± 5 x 10-4 accuracy). The invention of new technologies for the detection of electrons and muons allowed me to start searching for a new lepton and to make a series of high precision QED tests. This activity culminated in the discovery by others of the third lepton (now called t) to which I have devoted ten years of my life.

2. *Matter-Antimatter Symmetry*

The violation of the symmetry operators (C, P, T, CP) and Matter-Antimatter Symmetry. I was very much intrigued by the great crisis arising from the discovery that the basic invariance laws (charge conjugation C, parity P, time reversal T) were not valid in some elementary processes.

Together with the successes of the S-matrix and the proliferation of 'elementary' particles, the powerful formalism called Relativistic Quantum Field Theory (RQFT) appeared to be in trouble. These were the years when the RQFTs were only Abelian and no one was able to understand the nature of the strong forces. The discovery of CP breaking gave a new impetus to the search for the first example of nuclear antimatter: in fact the antideuteron had been searched for and found not to be produced at the 10-7 level. The order of magnitude of its production rate was unknown and finally found to be 10-8. This level of detection was reached by my group thanks to the construction, at CERN, of the most intensive negative beam and of the most precise time-of-flight detector.

3. *Mesons Mixings*

The mixing in the pseudoscalar and vector mesons: the physics of Instantons. Another field thoroughly investigated by me is the mixing properties of the pseudoscalar and of the vector mesons, realized through the study of their rare decay modes. This could be accomplished thanks to the invention of a new detector, the neutron missing mass spectrometer.

The physics issues could probably be synthetized in terms of the U(1) problem. In other words, why do the vector mesons not mix while the pseudoscalar mesons mix so much? This

issue found – after many decades – a satisfactory answer when G. ’t Hooft discovered how Instantons interact with the Dirac sea.

4. *Effective Energy*
The non-Abelian nature of the Interaction describing quarks, gluons and Effective Energy. Another puzzle to me was the enormous variety of multihadronic final states produced in strong, electromagnetic and weak interactions. Why are these final states all different? This appeared to be in contrast with the order of magnitude reduction in the number of mesons and baryons obtained, first with the eightfold way by Gell-Mann and Ne’eman and then with the quark proposal by Gell-Mann and Zweig.
The discovery of Scaling at SLAC and the non-existence of quarks found by us at CERN using the ISR was finally understood in terms of quarks, gluons, and their non-Abelian interaction. With the advent of quarks and gluons, the puzzle became even more intriguing since the multihadronic final states had to have the same origin. The introduction of the new quantity, ‘Effective Energy’, allowed the discovery of the Universality Features in the multihadronic final states produced in strong, electromagnetic and weak interaction, thus solving the puzzle. It is remarkable that the quantitative QCD description of ‘Effective Energy’ is still missing, since it is a non-perturbative QCD effect.

5. *The Supersymmetry Threshold and its Problems*
As early as in 1979, I pointed out the relevance of this new degree of freedom for the convergence of the three gauge couplings. More than a decade later (1991), I realised that a serious effort was needed to put order and rigour into this field where unjustified claims on the Supersymmetry threshold became very popular despite their total lack of validity. For example, no one had ever computed the effect of the Evolution of the Gaugino Masses (EGM), not only on the convergence of the gauge couplings but, and more importantly, on the Supersymmetry threshold. The EGM effect brought down the Supersymmetry threshold by nearly three orders of magnitude.

A Note Concerning Projects and Technological Developments
My physics interests made me very much concerned about the future of subnuclear physics. This concern lies at the origin of my activity devoted to the implementation of new projects: the Erice Centre for the implementation of a genuine scientific culture; the Gran Sasso project, now the largest and most powerful underground laboratory in the world; the LEP-white-book which allowed this great European venture to overcome the many difficulties that had blocked its implementation for many years; the HERA collider, now successfully running; the roots of LHC (the new CERN collider) i.e. the 5 metre diameter for the LEP tunnel, and the LAA-R&D project, implemented to find the original detector technologies needed for the new colliders.