

Simposio Internacional: El quark cumple 50 años

International Symposium: The 50th anniversary of the quark

Madrid, 10 de junio de 2014

Madrid, June 10, 2014

RESÚMENES/ ABSTRACTS

[Quarks: de hipótesis implausible a realidad sorprendente, Alvaro de Rújula](#)

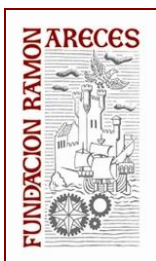
[La construcción del Modelo Estándar Electro débil, John Iliopoulos](#)

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Quarks: de hipótesis implausible a realidad sorprendente, Alvaro de Rújula

En pocos años alrededor de la “revolución” de noviembre de 1974 la física de partículas, viento en popa, cambió muy significativamente. La realidad de los quarks, inventados durante la Navidad del 63/64 —así como la veracidad del posterior “Modelo Estándar” de estas y las demás partículas elementales— pasaron de tener un puñado de defensores a generar innumerables adictos. Hablaré, desde la perspectiva de un testigo de estos hechos, de los principales pasos teóricos y experimentales referentes a los quarks. De su “libertad asintótica” y de la invención y crucial descubrimiento del “charmonio” (en noviembre del 74) y, poco después, de las primeras partículas que contenían un (sólo) quark “encantado”.

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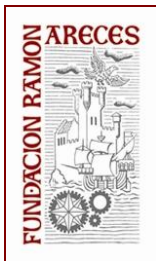
La construcción del Modelo Estándar Electrodébil, John Iliopoulos

The construction of the electroweak Standard Model has a long and fascinating history. I shall present the main steps without going into all the details. The concept of the quark played an important role, which, however, grew gradually as the theory was formulated and became more precise. From abstract mathematical objects, quarks became the fundamental elementary hadrons. Revolutions in Physics often occur when an unexpected experimental result contradicts the accepted theoretical paradigm. However, the revolution which brought Geometry into High Energy Physics had a theoretical, I would add an aesthetic, motivation. It triggered beautiful and ingenious experiments which changed our perception of the nature of the fundamental forces. It is this story I will try to present.

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El descubrimiento de la libertad asintótica y el nacimiento de la Cromodinámica Cuántica, Luis Álvarez-Gaumé

The strong interactions were discovered relatively early in the XXth century. For decades their scientific explanation defied the physics community due to its challenging complexity and the fact that we lacked basic elements in the conceptual scaffolding that eventually led to their understanding. Many fundamental new concepts were needed in the quest for an acceptable description. They involved the use of complex symmetries and their breaking,



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new quantum dynamical interactions, all culminating in the discovery of asymptotic freedom and the confinement of quarks, two basically quantum aspects of the theory that eventually provided a deep explanation of the strong force: Quantum Chromodynamics. We will present some of the breakthroughs leading to the formulation of this most fundamental theory.

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El triunfo del Modelo Estándar y el descubrimiento del bosón de Higgs, Tejinder Virdee

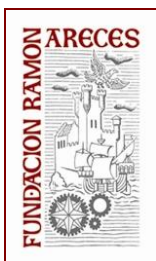
The standard model of particle physics has been “constructed” over the last 50 years through deep theoretical insights and painstaking experimental work. This talk will give a historical perspective of the seminal events that have taken place in the last 30 or so years. These include the discoveries of the W and Z bosons at the SppbarS collider, the bottom and top quarks at the Tevatron, and the precision tests at LEP and other accelerators. The talk will give a historical perspective of the monumental experimental effort resulting in the discovery of a Higgs boson in July 2012 at the Large Hadron Collider (LHC).

The LHC was built to tackle some of the most fundamental questions about the origin, the evolution and the composition of our universe. Particular questions to be addressed include: what is the origin of mass, what constitutes dark matter, are there extra dimensions of space, why is the universe composed of matter and not antimatter, and more. The prospects at the LHC over the next two decades also will be discussed.

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Los Quarks como herramienta para interpretar la estructura de la materia, Giora Mikenberg

A short historical review is presented on the experimental results that have proven that each additional family of quarks produced the expected increase in the e^+e^- annihilation cross-section, followed by the experimental prove that the quarks have fractional charged via the $\gamma\gamma$ processes. This is followed by a review on how the weak decays of the heavy quarks has been used to prove, before its discovery, the existence and the mass of the Top Quark. Finally, a presentation of how the weak decays of the heavy quarks allow us, via the weak decay loops to obtain information on the existence of possible new particles via the $b \rightarrow s\gamma$ and more recently via the B_s and $B_d \rightarrow \mu^+\mu^-$ decays on the existence of



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Super-symmetric particles. The presentation will be concluded by a presentation of the foreseen experiments that will allow to look for deviations of the Standard Model in heavy flavour decays.

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El futuro de la Física de Partículas Elementales, Sergio Bertolucci

En esta conferencia de clausura del Simposio se hará un resumen de los principales desafíos a los que se enfrenta la Física de Partículas Elementales tras el descubrimiento del bosón de B-E-H y de las iniciativas experimentales contempladas para el avance de la disciplina.

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