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Meson Spectroscopy in the Light Quark Sector

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Understanding the hadron spectrum is one of the fundamental issues in modern particle physics. We know that existing hadron configurations include baryons, made of three quarks, and mesons, made of quark-antiquark pairs. However most of the mass of the hadrons is not due to the mass of these elementary constituents but to the force that binds them. Studying the hadron spectrum is therefore a tool to explore one of the fundamental forces in nature, the strong force, and Quantum Chromo Dynamics (QCD), the theory that describes it. This investigation can provide an answer to fundamental questions as what is the origin of the mass of hadrons, what is the origin of quark confinement, what are the relevant degrees of freedom to describe these complex systems and how the transition between the elementary constituents, quarks and gluons, and baryons and mesons occurs.

In this field a key tool is given by meson spectroscopy. Mesons, being made by a quark and an anti-quark, are the simplest quark bound system and therefore the ideal benchmark to study the interaction between quarks and understand what the role of gluons is. In this investigation, it is fundamental to precisely determine the spectrum and properties of mesons but also to search for possible unconventional states beyond the $q\bar{q}$ configuration as tetraquarks ($qqqq$), hybrids (qqg) and glueballs. These unusual states can be distinguished unambiguously from regular mesons when they have exotic quantum numbers, i.e. combinations of total angular momentum, spin and parity that are not allowed for $q\bar{q}$ states. These are called *exotic* quantum numbers and the corresponding states are referred to as *exotics*.

The study of the meson spectrum and the search for exotics is among the goals of several experiments in the world that exploit different reaction processes, as e^+e^- annihilation, $p\bar{p}$ annihilation, pion scattering, proton-proton scattering and photoproduction, to produce meson states. This intense effort is leading to a very rich phenomenology in this sector and, together with recent theoretical progresses achieved with lattice QCD calculations, is providing crucial information to reach a deeper understanding of strong interaction.

In this talk I will review the present status of meson spectroscopy in the light quark sector and the plans and perspectives for future experiments.