Light-Meson Transition Form Factors

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The charge distributions of composite objects are characterized by *form factors*. Whether describing the cross sections for electron scattering off nucleons (composed of quarks and gluons) or nuclei (composed of nucleons), form factors parametrize the deviation from the scattering amplitude off a point-like object (like an electron); to study them allows us to learn something about the constituents as well as the strong interactions that bind them together [1]. The momentum dependence of the form factors can therein be understood as the Fourier transform of the charge distribution (within a certain reference frame).

Similar form factors can also be used to characterize the electromagnetic *transition* between different particles. In particular, we can also investigate the form factors of particles that cannot be prepared as targets in scattering experiments through the study of their *decays* into final states including an electron–positron pair. Of particular recent interest are the transition form factors describing the decays of light, flavor-neutral mesons (π^0, η, η') into one real and one virtual photon; with only one single hadron involved, it is this hadron's electromagnetic structure that can be understood in such decays.

In this working group, we want to concentrate on the decay $\eta' \to \gamma\, e^+e^-$. The decaying η' can be produced in the reaction $e^-p \to e^-\eta' p$ (electroproduction), for instance at the CLAS experiment at Jefferson Lab (Virginia, USA). We want to understand the existing experimental results for such form factors [2], how they can be understood and interpreted theoretically [3], and what their implications are for a wider range of modern particle physics problems of current interest [4]. Finally, we want to work on a proposal for improved experiments to measure the transition form factors.

References

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