Strange and charm hadron physics at J-PARC in future

H. Noumi[1]

[1]Reserach Center for Nuclear Physics, Osaka University

A number of hadrons, about 200 mesons and 150 baryons, are listed according to the Particle Data Group [1], However, their structure of masses and widths have not yet satisfactorily understood. The constituent quark model rather well describes properties of hadrons, but sometimes fails in excited states. For examples, the mass order of resonances, such as $N^*(1440)1/2^+$ or $\Lambda(1405)$ has not yet been clearly explained. Recently, unexpectedly narrow states in excited states, such as Θ^+, X, Y, Z, and Z_b, have been reported, which are hardly explained with simple $3q$ or $q\bar{q}$ configuration. This fact suggests that hadrons should be described with taking new effective degrees of freedom into account. It is necessary to investigate internal structure of hadrons further in order to reveal roles of effective degrees of freedom to form hadrons.

When a light quark is replaced by a heavy quark in a baryon, motions of the heavy quark and the other two light quarks split, which is due to the so-called isotope shift. The spin-dependent interactions with a heavy quark become weaker than those between light quarks since they are proportional to the inverse of the quark mass. As a result that the heavy quark rather act as an inert particle in baryons, a light diquark pair is expected to be singled out. Nature of the heavy baryons is then determined by dynamics of the diquark pair. Therefore, baryons with a heavy quark provide a unique opportunity to learn quark-quark correlation, where level structure and decay widths are expected to be determined simply by dynamics of the diquark pair. We found that the above-mentioned nature of the heavy baryons appears not only in level structure and decay widths but also in production rates [2]. In theory, it is quite meaningful to change the mass of heavy quark to understand how the level structure and other nature of baryons change. In experiment, relation of excited states among bottom, charm, strange and even unflavored sectors are connected. In this respect, the J-PARC hadron facility provides unique playgound in spectroscopic studies of hadrons with different flavors, in particular, strange and charm. I will introduce activities in hadron physics with heavy flavors at J-PARC.

[1] K.A. Olive et al. (Particle Data Group), Chin. Phys. C, 38, 090001 (2014).

[2] S.H. Kim, A. Hosaka, H.C. Kim, H. Noumi, and K. Shirotori, Prog. Theor. Exp. Phys. **103D01** (2014).