Determination of compositeness of hadronic resonances: The Λ(1405) radiative decay and the $a_0(980)$-$f_0(980)$ mixing

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In hadron physics, one of the most important tasks is to pin down the effective degrees of freedom for the structure of individual hadrons. Traditionally the quark model suggests that baryons consist of *qqq* and mesons of qq^{bar}, but at the same time some hadrons do not fit into the classification by the quark model, which motivates us to consider exotic structure of hadrons such as hadronic molecules and multiquark systems.

Recently concept of compositeness has been constructed so as to identify the hadronic molecules [1]. The compositeness is defined as contributions from hadronic two-body wave functions to the normalization of the total wave function of the hadrons and hence measures amount of the hadronic two-body composite states. By using compositeness, one can verify whether hadronic molecule candidates are really hadronic molecules or not.

In this contribution we discuss possiblities to determine the compositeness of hadronic resonances in experiments. We first investigate structure of the Λ(1405) resonance, which has been considered as a K^{bar} *N* molecule state, by the Λ(1405) radiative decay [2], and next investigate structure of the $a_0(980)$ and $f_0(980)$ resonances, which are expected to be $K\,K^{\mathrm{bar}}$ molecules or other exotic systems, by the $a_0(980)$-$f_0(980)$ mixing intensity [3]. For this purpose we establish two relations: one is a relation between the Λ(1405) radiative decay width and the K^{bar} *N* compositeness, and the other is a relation between the $a_0(980)$-$f_0(980)$ mixing intensity and the $K\,K^{\mathrm{bar}}$ compositeness for the $a_0(980)$ and $f_0(980)$ resonances. Then, combining the established relations and experimental data on the Λ(1405) radiative decay width and the $a_0(980)$-$f_0(980)$ mixing intensity, we discuss K^{bar} *N* molecular structure for the Λ(1405) resonance and $K\,K^{\mathrm{bar}}$ molecular structure for the $a_0(980)$ and $f_0(980)$ resonances.

References

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