Detector Physics focused on Spectroscopy Measurements

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In the last decades, numerous exotic states which cannot be described by the conventional quark model have been observed. To understand their nature, lots of scenarios, such as tetraquark, hadro-quarkonium, hybrid, hadronic molecule and so on, are proposed. For these various theoretical models, recently, many reviews [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13] have been written.

According to their different dynamics, these various scenarios have different physical impacts, such as production rate, decay pattern, spectroscopy and so on. Among them, spectroscopy has been systematically studied to disentangle the hadro-charmonium picture, the tetraquark picture and the hadronic molecular picture for these exotic candidates in heavy charmonium region [14], by employing heavy quark spin symmetry. The patterns emerging from the different models turn out to be quite distinct. Thus the measurement of the full spectrum in a new experiment would shed light on their nature.

In this working group, we focus on measuring the spectra in the charmonium region arising from hadro-charmonium, tetraquark and hadronic molecular pictures, respectively. In particular, the mass positions of the states with $J^{PC} = 0^{-+}$ comparing to that of the $Y(4260)$ would be very helpful to distinguish these three scenarios. Furthermore, the mass of the $J^{PC} = 3^{--}$ state would also help to distinguish the tetraquark scenario from the hadronic molecular scenario.

To measure the 0^{-+} and 3^{--} states with highest precision we want to propose a new detector. We have to understand new detector technologies, their interplay and how they can be arranged to measure the states we are interested in.

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