Contribution ID : **25** Type : **not specified**

Partial wave effects in the heavy quarkonium radiative electromagnetic decays

Saturday, 27 April 2024 14:40 (20)

In a previous paper, it was pointed out that the wave functions of all particles are not pure waves, besides the main partial waves, they all contain other partial waves. It is very interesting to know what role these different partial waves play in particle transitions. Therefore, by using the Bethe-Salpeter equation method, we study the radiative electromagnetic decays $\psi \to \gamma\chi_{cJ}$ and $\Upsilon \to \gamma\chi_{bJ}$ $(J = 0, 1, 2)$. We find that for the S and P wave dominated states, like the $\psi(2S)$, $\Upsilon(2S)$, $\chi_{cJ}(1P)$, and $\chi_{bJ}(1P)$ etc., the dominant S and P waves provide main and nonrelativistic contrition to the decays; other partial waves mainly contribute to the relativistic correction. For the states like the $\psi(1D)$, $\Upsilon(2D)$, $\chi_{c2}(1F)$, and $\chi_{b2}(1F)$ etc., they are the $S-P-D$ mixing state dominated by D wave or the $P-D-F$ mixing state dominated by F wave. Large decay widths are found in the transitions $\psi(2D) \to \chi_{c2}(1F)$, $\Upsilon(1D) \to \chi_{bJ}(1P)$, and $\Upsilon(2D) \to \chi_{bJ}(2P)$ etc., which may be helpful to study the missing states $\chi_{c2}(1F)$, $\Upsilon(1D)$, and $\Upsilon(2D)$.

Primary author(s) : SU-YAN, Pei ([redacted])

Co-author(s) : WEI, Li; TING-TING, Liu; MEMG, Han; GUO-LI, Wang; TIAN-HONG, Wang

Presenter(s) : SU-YAN, Pei ([redacted])

Session Classification : [redacted] 1