The electromagnetic decays of X(3823) as the "ψ" _⌧(⌧^⌧ ⌧_⌧) state and its radial excited states

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We study the electromagnetic (EM) decays of $X(3823)$ as the $\psi_2(1^3D_2)$ state by using the relativistic Bethe-Salpeter method. Our results are $\Gamma[X(3823) \rightarrow \chi_{c0}\gamma] = 1.2$ keV, $\Gamma[X(3823) \rightarrow \chi_{c1}\gamma] = 265$ keV, $\Gamma[X(3823) \rightarrow \chi_{c2}\gamma] = 57$ keV and $\Gamma[X(3823) \rightarrow \eta_c\gamma] = 1.3$ keV. The ratio $calB[X(3823) \rightarrow \chi_{c2}\gamma]/calB[X(3823) \rightarrow \chi_{c1}\gamma] = 0.22$, agrees with the experimental data. Similarly, the EM decay widths of $\psi_2(n^3D_2)$, $n = 2, 3$, are predicted, and we find the dominant decays channels are $\psi_2(n^3D_2) \rightarrow \chi_{c1}(nP)\gamma$, where $n = 1, 2, 3$. The wave function include different partial waves, which means the relativistic effects are considered. We also study the contributions of different partial waves.

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