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|Upsilon(1S)–>\Gamma(\eta',\eta,f_2(1270)) decays

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\documentstyle[12pt]{article}
\def\today{}
\textwidth 18.3cm
\textheight 23.2cm
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\topmargin -1.50cm
\begin{document}
\title{$\Upsilon(1S) \to \gamma(\eta', \eta, f_2(1270))$ decays }
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\maketitle
In this talk the study of $\Upsilon(1S) \to \gamma(\eta', \eta, f_2(1270))$ decays
is presented.

Comparing with decays $J/\psi \to \gamma(\eta', \eta, f_2(1270))$,
very small upper limits
\[B(\Upsilon(1s)\rightarrow\gamma\eta)<1.0\times10^{-6},\;\;
B(\Upsilon(1s)\rightarrow\gamma\eta')<1.9\times10^{-6}\]
and larger
\[B(\Upsilon(1S)\rightarrow\gamma f_2(1270))=(10.2\pm0.8\pm0.7)\times 10^{-5},\]
%\[B(\Upsilon(1S)\rightarrow\gamma f_2(1270))=(10.5\pm1.6(stat)^{+1.9}_{-1.8}(syst))\times 10^{-5}\]
have been reported by CLEO.
Dependence on quark mass plays key roles in these decays of J/ψ, $\Upsilon(1S)$. An approach
in which η' and $f_2(1270)$ are strongly coupled to gluons has been used to study these decays.
This approach has successfully predicted
\[\frac{\Gamma(J/\psi\rightarrow\gamma\eta')}{\Gamma(J/\psi\rightarrow\gamma\eta)}=5.1\]
and very small \(y=T_2/T_0\)($J/\psi \to \gamma f_2$) which agrees with data well.
By using this approach very strong quark mass dependence
\[\frac{B(\Upsilon\rightarrow\gamma\eta')}{B(J/\psi\rightarrow\gamma\eta')}=
0.29\frac{\alpha_s(m_c)}{\alpha_s(m_b)}({m_c\over m_b})^7\]
is obtained. Inputting $B(J/\psi \to \gamma\eta')$,
\[B(\Upsilon\rightarrow\gamma\eta')=1.04\times10^{-7},\;\;B(\Upsilon\rightarrow\gamma\eta)=0.23\times10^{-8}\]
are obtained. They are in good agreement with data. The study shows that
d-wave dominance in $\Upsilon(1S) \to \gamma f_2(1270)$ is the consequence of the strong coupling
between f_2 and gluons and an enhancement factor, $\frac{p_\Upsilon^4}{p_J^4}$, in the ratio of the decay rates is resulted
in the d-wave dominance. Like $\Upsilon(1s) \to \gamma\eta'$ there is suppress factor by m_b in
$\Upsilon(1S) \to \gamma f_2(1270)$. The combination of these two factors lead to larger
$B(\Upsilon(1S) \to \gamma f_2(1270))$. On the other hand, very small ratios of the helicity amplitudes
are predicted and they agree with data.

Right quark mass dependencies of $\Upsilon(1s) \to \gamma(\eta', \eta, f_2(1270))$ are revealed from the
couplings between the mesons and gluons. Theoretical results agree with data well. In this study \(m_c=1.3GeV\)
and
$\bar{M}S$
mass of b-quark are taken.
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